RAILWAY ENGINEERING

and Maintenance of Way

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MAHAM H. HAIG, Managing Editor — W. C. SPRAU, Editor
CHARLESB A. BLAKE, Asst. Secretary — WARREN EDWARDS, Manager

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Contents

Suggestions from Our Readers

IT HAS been suggested, by one particularly interested, that the publishers of this paper should adopt a custom of giving monthly the prices on different track materials, (including concrete supplies, etc.) F. O. B. Chicago. It is gratifying to learn that our friends have the publication well enough at heart to make such suggestions. As far as possible, the wishes of our readers will be fulfilled, and beginning with the February number the custom thus suggested will be started. It is hoped that this material will aid the engineer or contractor in making estimates on future work, etc. Should there be any other material which may appeal to our readers as being valuable, a word from them, making known the subject, is solicited.

Reinforced Concrete Poles

IT IS interesting to note the rapid stride that is being made in substituting reinforced concrete for wooden structures. Probably the latest developments along this line is the reinforced concrete telegraph pole. It will no doubt be interesting to know that the Richmond Home Telephone Company of Richmond, Indiana, is using a reinforced concrete pole. The reinforcement consists of four corrugated iron rods. The pole is octagonal in shape, thirty feet long and provided with mortises for cross arms, which are fastened in place by means of iron bolts. Mortises were also built in the pole to aid the linemen in climbing.

Interest Shown in Cement Convention

THE impression existing for years among railroad engineers and contractors that masonry is the most desirable material for bridge abutments, piers and culverts would seem to have been changed materially by developments in the use of cement. This was emphasized particularly by the extreme interest which was shown in the use of cement, evident by the remarks and papers presented before the recent convention of the Cement Users' Association held in Chicago during the past month.

The meetings of this association attracted much attention and the attendance, as well as the number of exhibits, far exceeded the expectations of the officers and members of the association. That manufacturers appreciated the value of being represented is shown by the fact that it was necessary to refuse accommodation to many manufacturers of cement users' material because of the limited space available for exhibitors, even though the large Armory of the Seventh Regiment, in Chicago, had been reserved for exhibition space.

At this time unusual progress is being made with concrete construction, and all those interested in this line of work are busily employed. As one of the contractors at the convention remarked, "Concrete construction is no longer an experiment, but is something that has come to stay."

Positive Signaling Systems

THE recent wrecks on the Big Four Railway at Fowler, Indiana, and on the Baltimore & Ohio Railroad at Terra Cotta, D. C., have aroused the attention of many railroad managers and engineers through out the country. For those who are not familiar with the conditions which existed at the time of these wrecks it would seem pertinent to say that the Big Four accident at Fowler, Indiana, happened at night and during a heavy fog. The B. & O. wreck occurred under similar conditions, though the time was earlier in the evening. It is claimed the engineer on each of these trains failed to see the danger signal displayed on account of the dense fog which existed at the time.

As these wrecks were unavoidable in a way, due to the weather conditions, it would seem worth while to look into the matter of a more positive signaling system and not depend so much upon the eye of the engineer.

In England some use has been made of the torpedo placer, and a very little use of the same has been made in this country. This device places a torpedo upon the rail simultaneously with the setting of the signal to danger. With this arrangement the train will run some distance into the block before the engineer will, under the circumstances, apply his brakes.

Another method is the automatic stop. Its advantage is that the brakes are applied by the time the engineer is informed he has passed a signal with danger displayed. Giving the engineer all due credit for knowing the road and where he is at the time, he may under unusual circumstances—say, for instance, during a fog—overlook a certain signal and run by it. This may or may not result disastrously.

With the aim of obviating all possible human fallibility along the line under discussion, it may be expedient for railroad managements to give careful consideration to some such method as described.

Improvement of Roadbed

WHILE the maintenance of roadbed is naturally expensive, there are a number of features entering into the expense of track construction and repair which justify a high initial cost, where the expense will ultimately prove a paying investment by providing for future economy. In this connection the matter of beautifying the right of way within practical and reasonable limits is a consideration of more than passing interest. Grass covered banks, sloping smoothly, where cuts are made, constitute an attractive feature that impresses passengers favorably. While grass in such locations is pleasing to the eyes of the passengers and is ornamental, it represents a factor of economy which is useful.

Water flowing down unsodded slopes causes erosion, washing dirt and stones into the ditches along the roadway and thus interfering with efficient drainage. Perfect drainage is absolutely essential and when this is provided a large portion of the difficulty in maintaining roadbed is obviated.

The width and depth of ditches required by good engineering practice necessitates a decided slope in many places along a right of way, in order to secure good drainage. Naturally these ditches must be kept unobstructed and unless some provision is made to prevent water from washing away dirt and other material from the slopes, the ditches will become partially choked.

Grass furnishes a very efficient provision against the erosive effect of water, for during a rain the water will flow over a grassy slope without carrying anything with it. By failing to disturb material on the slopes and by not bringing obstructions into the ditches, the water has a free scope in following the ditches to the nearest outlet.

Good ballast that will insure proper drainage is more expensive in first cost than ordinary dirt roadbed and the cost of sodding with blue grass entails an even greater item of expense. In the long run, however, the greater first cost will represent economy in maintenance expenses.

The Value of Discussion

THE effect upon questions constantly at issue in rail road work is so frequently changed by circumstances and environment that the standpoint from which a given subject is viewed is dependent upon different conditions; and criticisms offered are naturally dissimilar as they are prompted by the teachings of experience which vary more or less according to surroundings. For this reason we wish to induce discussions through our columns in order to bring out the important features of the several sides of questions. Following the presentation of a subject we are sometimes told by our visitors or correspondents that the practice we advocate is proving quite successful and is identical with the lines along which they are working, while others advance objections that the same course is not suitable to their conditions and others again suggest modifications of different practices.

We like to see experiences exchanged and therefore advocate discussions. We feel that an editorial or communication which excites discussion is productive of good results, as it induces an exchange of views among men who have given a subject deep consideration by whose experience others may benefit.

In this connection the railroad clubs might be consistently reminded of the benefit of critical discussion. We know men who have been disappointed at the reception of papers presented, not because of any lack of appreciation of their efforts or of the value of their papers, but because of the seeming lack of interest in the subject through absence of discussion followed by accepting the ceremonious disposition of the paper. When presenting a paper it is not uncommon for the author to prepare to meet arguments which may arise during the consideration of the subject matter, by bringing with him data and statistics with which to convince those who may take exception to his statements or may not agree with theories advanced. Furthermore the treatise of a subject not in accordance with generally accepted practice, yet based on practical demonstration, is valuable in drawing forth criticisms and suggestions for further research.

New Shops—El Paso & Southwestern Railroad

By J. S. Campbell, Engineer Maintenance of Way.

THE El Paso & Southwestern Railway is owned and operated by Phelps, Dodge & Co., of New York, in connection with its copper mines and smelters, and coal and timber fields in Arizona, New Mexico and Mexico. Its location is shown in Fig. 1. It is one of the largest standard gauge industrial roads in the country, being constituted of 883 miles of line. With the exception of the original line from Benson to Bisbee, Ariz., a distance of 66 miles, the entire system has been created in the last ten years. It is in consequence, an up-to-date road, comparing favorably with the transcontinental lines of the southwest.

It lies partly on the Pacific and partly on the Atlantic slope of the southern extremity of the Rocky Mountain

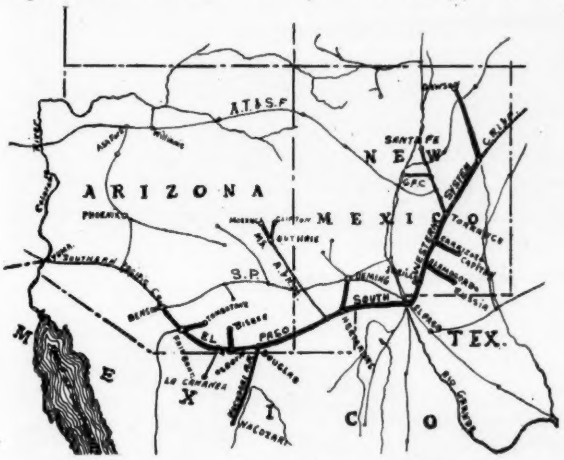


FIG. 1.—LOCATION OF EL PASO & SOUTHWESTERN RY.

plateau, and crosses the continental divide on a 1 per cent. grade, which is also the maximum for main lines. The maximum curvature for the same is 6 degrees. On the main line there are one tangent 43 miles long, one 22 miles, two 21 miles, one 19 miles, and a goodly number of 5 to 10 miles in length. On the branch lines there are some notable features.

Of these, the Alamogordo & Sacramento Mountain Railway, a standard gage lumber line, rises from an elevation of 5,000 feet at Alamogordo, N. M., to an elevation of 9,000 feet at Cloudcroft, on the top of the Sacramento mountain—an ascent of 4,000 feet in a developed distance of 26 miles on 30 degree curves, and 5 per cent. grades. At Bisbee, Ariz., one of the largest copper camps in the United States, a complete network of tracks girdle the hills and serve the numerous mines. At Douglas, Ariz., the great smelters are likewise served. The standard weight of rail is 80 pounds. The roadbed is being ballasted by smelter slag and crushed rock, of which about 90 miles are completed.

Being a new road, the equipment is up-to-date; the ore, coal and coke cars being built entirely of steel, and of 100,000 pounds capacity, while the average weight on locomotive drivers is greater than on any other road in the southwest. The daily ore trains from Bisbee to Douglas carry regular trainloads of 3,500 tons.

The road originally extended from Benson, Ariz., to El Paso, Tex., with a branch into Mexico. To place the production of their mines and smelters on a permanently economical basis, Phelps, Dodge & Co. set out in 1904 to acquire the necessary fuel supply. The result was the purchase of the El Paso & Northeastern Railway, running from El Paso, Tex., to Dawson, N. M., a distance of 264 miles, and the purchase of 45,000 acres of fine commercial and coking coal at Dawson including a large coking plant which is now being enlarged by the addition of 400 ovens. The road thus renders the double service of bringing the ores from the west and the fuel from the east to the smelters. In addition, it carries the

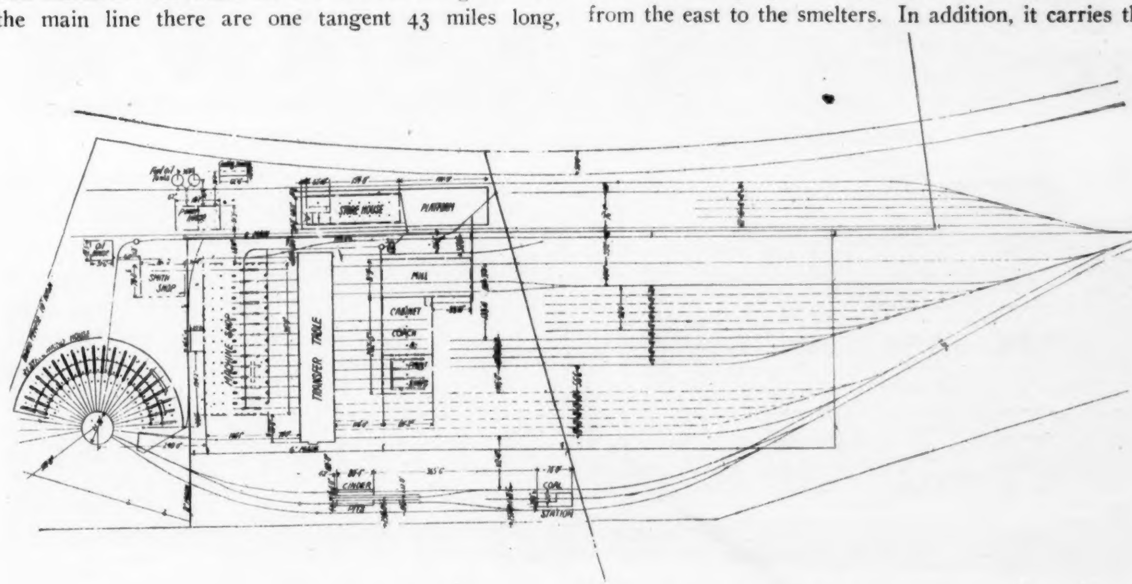


FIG. 2.—GENERAL LAYOUT OF SHOPS AND YARDS—EL PASO & SOUTHWESTERN RY.

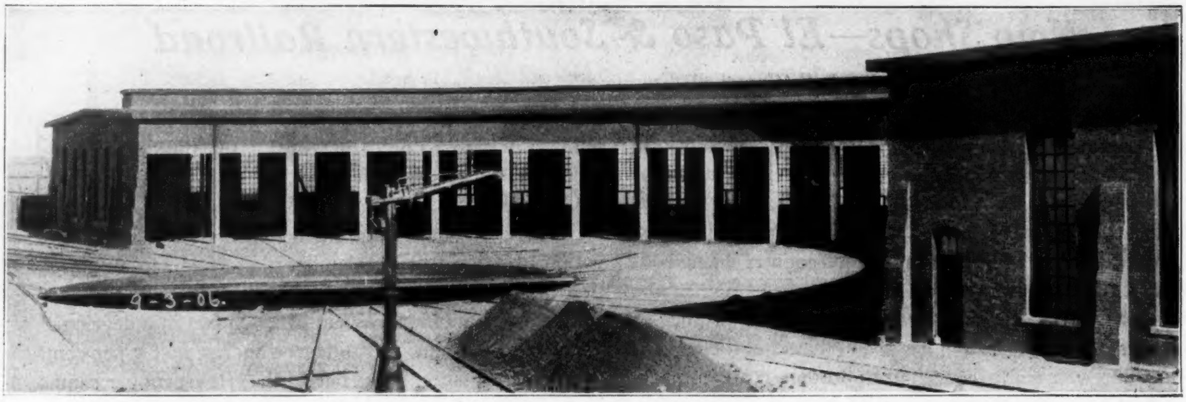


FIG. 3.—ROUNDHOUSE—EL PASO & SOUTHWESTERN RY.

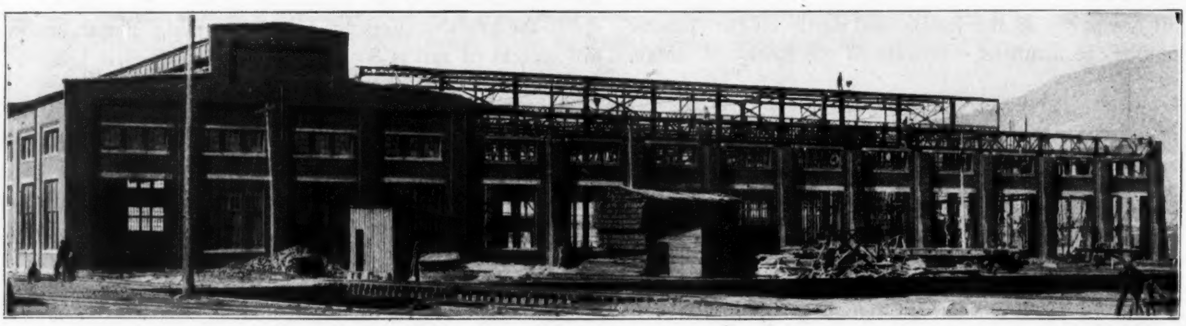


FIG. 4.—MILL, PAINT, COACH AND CABINET SHOPS—EL PASO & SOUTHWESTERN RY.

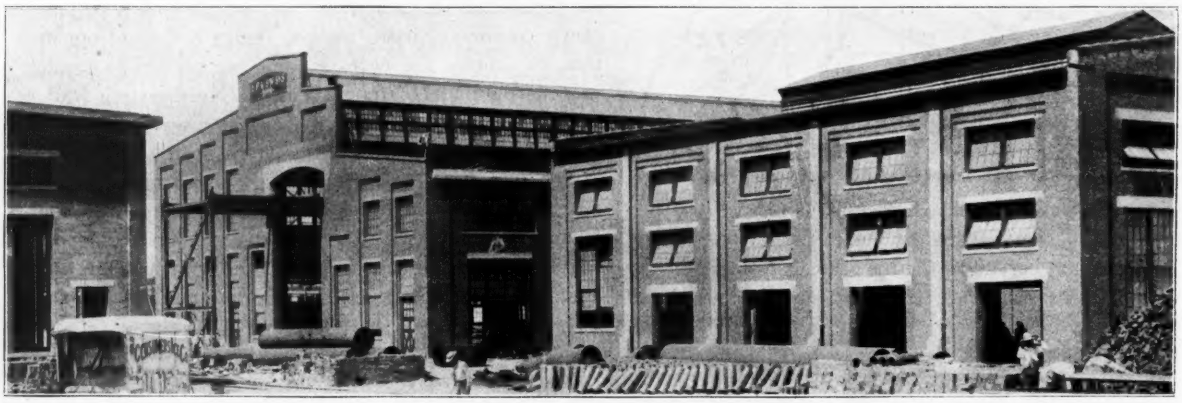


FIG. 5.—POWER HOUSE, MACHINE AND BLACKSMITH SHOPS—EL PASO & SOUTHWESTERN RY.

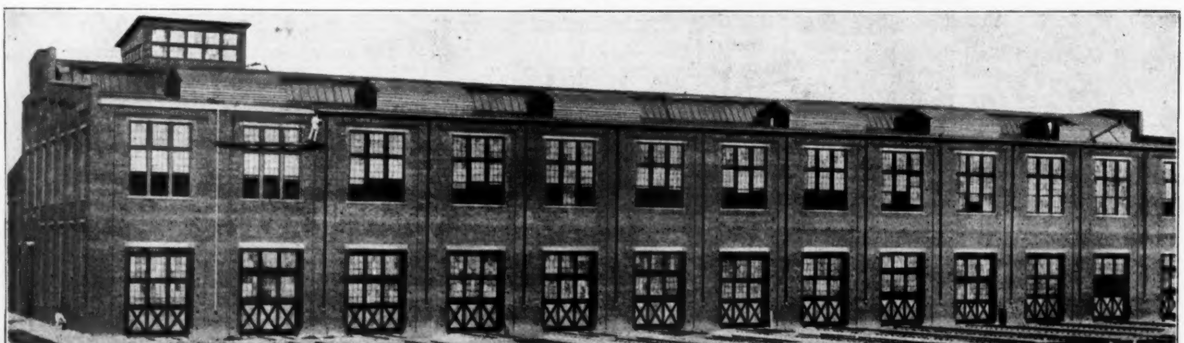


FIG. 6.—MACHINE AND ERECTING SHOP—EL PASO & SOUTHWESTERN RY.

traffic for the great copper camp at Cananea, Mex.; has a large local business, and it is the connecting link between the Rock Island at Santa Rosa, N. M., and the Southern Pacific at El Paso, the Rock Island's California and Mexico business being carried over the Eastern division of the road.

To maintain the equipment for this traffic, the railroad shops forming the subject matter proper of this article have been located and built at El Paso, Tex. El Paso is the geographical and traffic center of the system; is a hustling, thriving Western city; has splendid railroad facilities and a rich mining country of 400 miles radius surrounding and tributary to it. Accordingly, a tract of 64 acres of land adjoining and forming an extension of the existing yards in El Paso was purchased in the spring of 1905, and the construction of the shops begun in August of that year. The work was finished in December of last year. The construction time extended over a period of sixteen months.

The buildings (except the interior of the roundhouse and the storehouse) are built of concrete, brick and steel. The following is a list of the principal structures:

A 21-stall roundhouse 85 ft. deep.
A machine shop 137x320 ft.
A smith shop 70x100 ft.
A mill building 80x200 ft.
A paint, coach and cabinet shop 110x208 ft.
A transfer table and pit 75x400 ft.
A store house 60x200 ft.
A power house 50x100 ft.
An oil house.
A coaling station of 800 tons daily capacity.
Underground concrete fuel oil tanks.

The general map, Fig. 2, shows the ground plan of the layout. Photographic views of the stage of construction fine, clean sand. All excavations were thoroughly slushed

FIG. 7.—INTERIOR OF ROUNDHOUSE—EL PASO & SOUTHWESTERN RY

with water before any concrete was placed, the result being ideal foundations of great uniformity and sustaining power, in which settlement, if any, will be evenly distributed throughout.

The pressure on the sand is limited to one ton per square foot for moving loads, and two tons for static loads. There is no doubt that these could have been increased 50 per cent. without harm, but the necessary widths of footings to carry the superstructure dimensions of walls, etc., generally required but slight additional widths to keep within the above maxima. In the case of isolated piers carrying heavy loads, wide and comparatively thin reinforced footing slabs were used, resulting in economical foundations. The result of these excellent foundations is seen in the total absence of any settlement cracks or appreciable settlement in all structures.

All foundation footings and walls are exclusively of

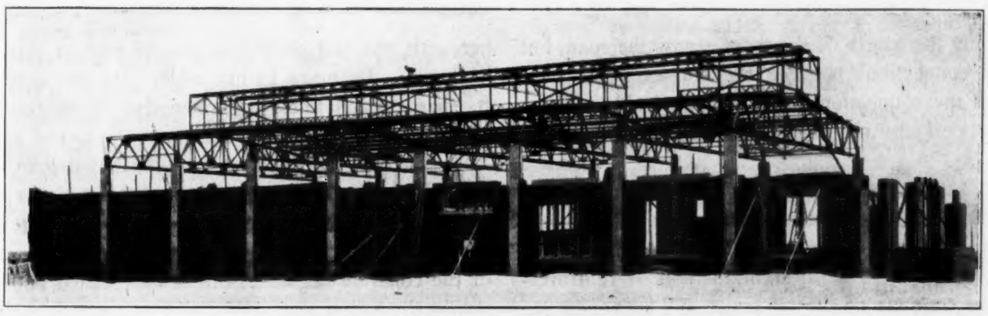


FIG. 8.—MILL BUILDING DURING CONSTRUCTION—EL PASO & SOUTHWESTERN RY.

were taken at the end of each month and we reproduce herewith a large number of selections from these, as they show the character and construction of the buildings better than line drawings or an extended description.

There are complete systems of water supply, drainage, sewerage and fire hydrants for all buildings and storage platforms and tracks, and city water and sewer mains crossing the grounds. The shop site lies in the Rio Grande valley, and all trenches and pits for the foundation footings and walls extend down into a deep bed of

1-3-5 concrete. In all engine pits, transfer pit, ash pit, turntable pier, etc., subject to moving loads, the concrete footings and walls are reinforced throughout, resulting also in the absence of any cracks or appreciable settlements. Portland cement of a half-dozen different brands was used. Each shipment was stored and tested on the ground before using. Occasionally a lot was rejected, but, with rare exceptions, all of it met the requirements—the tests recommended by the Am. Soc. C. E. and the specifications of the U. S. Government Service.

A special feature of reinforced concrete is found in the reinforced columns carrying the steel roof trusses of the oil house, power house, smith shop and mill building, having clear spans of 40 to 80 ft. A reference to the photographic reproductions showing these columns in various stages of construction will give a clear idea of their character and function in taking care of all roof loads and stresses carried by the trusses. In addition, they add materially to the stability of the walls.

In the smith shop and mill building these columns were erected first as shown in the photographs and the roof trusses afterward erected on and riveted to them by a detail of the reinforcement, which comprised a vertical angle running up throughout the length of the columns and properly punched for the riveted connection to the truss at the top, after which the column was carried on up around this connection and enclosed at the end of the truss level with its top chord. The reinforcement of the column extends from the bottom of the foundation footing to the top of the truss. The erection of these columns required great care and precision, since they had to fit not only the length of the truss across the span, but the lateral connections between the trusses also. Fortunately all the connections came out admirably without the necessity of any repunching or modifications of the details.

But the care, time and anxiety consumed, and the rather expensive forms required in maintaining the alignment of the columns in two directions as they went up led to the adoption of a different method of reinforcement in the columns of the oil house and power house. Indeed, this last method was the one originally outlined, but temporarily laid aside for the one above described. It consisted in first erecting the roof trusses on light latticed steel columns containing metal in quantity and position sufficient for the reinforcement. After the trusses were so erected and the lateral connections made, it required only ordinary care to build up the concrete around the steel expeditiously and economically, and with absolute certainty that everything was all right. In each side of each column there is a groove into which the brick walls were mortised as they were laid up after the columns were finished.

FIG. 9.—MACHINE AND ERECTING SHOP UNDER CONSTRUCTION—EL PASO & SOUTHWESTERN RY.

In the oil house, however, after the steel was all erected, the brick walls were next built with the required tenons on the faces to connect to the columns. The latter were then moulded into place around the steel and brick. This method required practically no form work: gave the best union between brick and concrete; and is the one that the writer would follow in the future. Inasmuch as the brick walls were laid in cement mortar, the construction as a whole is very strong and rigid. In the power house, the columns also carry the tracks carrying the 10-ton hand crane, while heavy lines of shafting are carried on the trusses in the smith shop and mill building. Where the latticed steel columns were adopted as the reinforcement, their anchor-bolts extend down to the bottom of the concrete foundations.

Another feature is the use of straight reinforced concrete sills and lintels for all doors and windows except in the south end of the machine shop, where a reinforced arch spans the wide opening for the passage of a 10-ton electric material crane. Over all engine door openings, the clear span of the lintel is 12 feet. In an illustration herewith, the test to destruction of two of these lintels is shown. They are 13 ins. wide, 12½ ins. deep and 12 ft. span. Each lintel contained five ⅞-in. round rods, whose centers were 11½ ins. from the top of the beam. The first one failed when the distributed load on both was 68,000 lbs. and the second one did likewise with a like load of 72,000 lbs. The deflection of the first was 1⅛ ins., and of the second 1 in. when appreciable crushing of the concrete began. Both beams settled and crushed slowly through a period of about 20 seconds each. Both were reinforced against shear. Below the steel only two small cracks showed in each beam in the middle of the spans under the crushed top, as shown in the photographs. These lintels and all others were made of 1-2-4 concrete.

All sills were cast on the ground, but all lintels were cast in place on the walls. The combination of the concrete columns, sills and lintels with the red brick of the walls gives a pleasing and finished appearance to the buildings, as is indicated by the illustrations.

The oil house is a fire-proof building with a reinforced concrete floor over the basement. All its windows are

provided with screens. The fuel oil tanks are also of reinforced concrete. They are built under-ground in the rear of the power house. They are covered with flat reinforced slabs whose tops are about 4 inches above the top of the adjacent power house yard track and will take oil directly from the cars through an 8-in. receiving pipe opening upward in the middle of the track as shown. Before these tanks were built, a small test-tank of 1-2-4 concrete was built and filled with fuel oil to determine the penetration and effect of the oil on the concrete. At the end of nine months, this test-tank is still full of the original oil, the level of the latter having fallen in that time only 5/8-in., due doubtless to evaporation, as the tank proved absolutely tight, the oil having penetrated and discolored the concrete less than 1/2 in. The latter is apparently still entirely sound and uninjured. In no case has there been any failure of any of the reinforced concrete above described.

Wood was used in the interior of the roundhouse and in the floors of the machine shop and mill. In the roundhouse it was used as being preferable to steel on account of corrosion, and to reinforced concrete as less expensive. For the same reasons, the doors, when installed, will be wood slat rolling doors. In the floors of the buildings specified, wood was used in preference to concrete in deference to the opinion of the superintendent of motive power that concrete was very tiresome on the feet and legs of the men standing all day about the machines. These floors are spiked to timber sleepers imbedded in clean sand slushed down and dressed flush with the tops of the sleepers, the floor being in full contact with the sand. This makes a very solid floor. A concrete floor in the machine shop would have cost $1,500 less than the wood.

All door openings for the passage of engines and cars in the various buildings are 12x17 ft. in the clear. Each door is built in three counter-balanced sections, lifting vertically and telescoping like the sashes of a window, the upper two sections, in fact, being filled with corrugated glass lights. As shown by the illustrations, the construction of these doors and their guides and hangers is quite substantial. A glance at these will also show that the buildings are liberally provided with light. The ventilators and, generally, the upper lines of windows are hinged; each line of lights being opened and closed by one line of sash operator worked from the floor. All lights, except in the office end of the store house, are corrugated or ribbed glass, giving a diffused light.

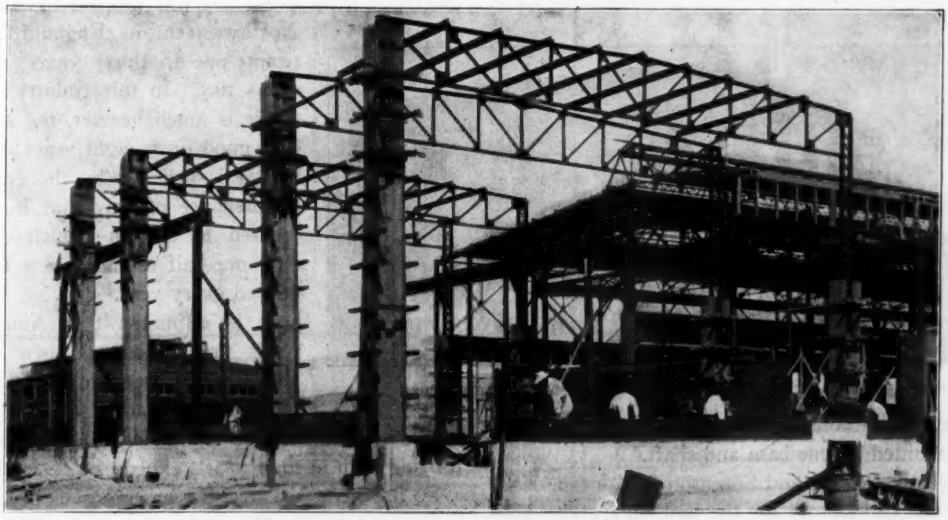


FIG. 10.—POWER HOUSE UNDER CONSTRUCTION—EL PASO & SOUTHWESTERN RY.

The buildings are covered with 3-ply Ruberoid roofing, under the contractor's guarantee of five years and the manufacturer's guarantee of ten years. On account of the light rainfall at El Paso (10 inches per year), this roofing was adopted on account of its inexpensiveness, but it may be a question whether this was altogether wise. It has been discovered that this roofing suffered some damage on account of the workmen tramping on nails, broken glass, etc., dropped on the roof during the erection of the skylights and ventilator lights, resulting in a number of leaks during a recent heavy rain. However, this could hardly be charged to the roofing, but, rather to an improper order of work.

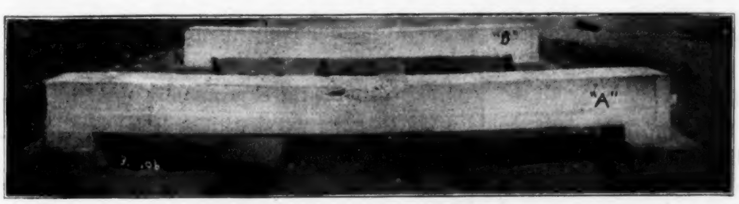


FIG. 11.—TEST OF LINTELS—EL PASO & SOUTHWESTERN RY.

The machine shop and mill, paint, coach and cabinet shops are provided with good lavatories and closets. An 8-ins. city water-main passes between the principal buildings, from which all necessary water connections are taken, including 6 and

4 ins. branches. This 8-ins. main will be connected at both ends to the water works system and will maintain a normal pressure of 80 lbs. There are 10 fire-hydrants conveniently located about the shop grounds and buildings. A city 18-ins. sewer line crosses the grounds The drainage and sewage of the shops are conducted to this through 12 and 8-in. vitrified pipe. The drainage of the round house, machine shop and coach and cabinet shop is first collected in large, specially constructed settling basins, and the sludge, grease, etc., collected there and kept out of the city sewers.

The entire terminal plant is operated by electric and pneumatic power generated in a central power station. The direct current electric power is generated by three separate units, each consisting of a steam turbine and a generator mounted on one base and shaft.

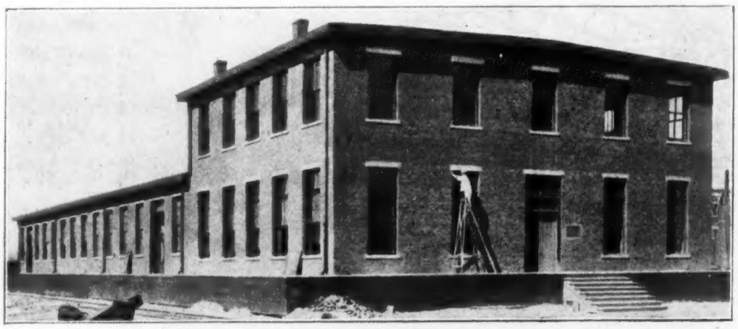


FIG. 12.—STOREHOUSE AND OFFICE BUILDING—EL PASO & SOUTHWESTERN RY.

Messrs. Frank Powers and Sorenson & Morgan, of El Paso, were the contractors for the buildings. The Missouri Valley Bridge & Iron Works, of Leavenworth, Kansas, fabricated and erected the steel frames of the buildings. Pawling & Harnischfeger, of Milwaukee, manufactured and erected the 100-tons main crane. Geo. P. Nichols & Bro., of Chicago, made and installed the transfer table, and the Link-Belt Machinery Co., of Chicago, erected the coaling station.

The work as a whole was under the management of H. J. Simmons, general manager of the road. Thos. Paxton, superintendent of motive power, planned the ground layout and selected and is installing the mechanical equipment. The buildings, etc., were designed and erected under the direction of the writer.

Experiments with Steel Ties—Pennsylvania Railroad

THREE thousand steel crossties have been installed on the main line of the Pennsylvania Railroad between Pittsburgh and Altoona. While cultivating trees to make certain a steady supply of timber, the company has determined to make thorough tests to discover, with scientific accuracy, how well metal ties are adapted for practical use. An experiment is being made on a stretch of road where traffic is very heavy.

Every year the demand for railroad ties increases and the drain on the country's forest resources is becoming more and more apparent. Some railroads have begun tree cultivation on a large scale, co-operating with the forestry departments of the National and State governments. More than a million trees have been planted already by the Pennsylvania Railroad. In the nursery at Hollidaysburg are some 300,000, which will be transplanted this year. In the vicinity of Altoona a tract of 14,000 acres is available for the planting and preservation of trees.

The company is making arrangements to treat soft wood ties with creosote and thereby almost double the length of their lives. By this method the London and Northwestern, in England, gets from twenty-one to thirty years' service out of its ties. In this country, where the traffic is much heavier, the average life of a good tie is eight years; by creosoting, it is believed by the engineers on maintenance of way that it can be increased to sixteen—which means that only one-half as many new ties will be needed every year.

It is estimated that American railroads use 110,000,000 new ties annually, at an average cost of 70 cents per tie. By cultivating trees and by the creosote treatment the railroads will materially reduce this big item in their year's expenses.

So far the use of steel ties has not gone beyond the experimental stage. The 3,000 ties on the Pittsburgh Division of the Pennsylvania are made of a special five-inch I beam with top and bottom faces, four and eight inches respectively. The rails are attached to the ties by steel clips.

Another form of tie which is being tested on the main line of the Pennsylvania Railroad is made of steel and is filled with a mixture of asphalt and rock. The steel facing extends around three sides of the tie, the asphalt being exposed on the under side, which rests on the ballast.

The size and shape are the same as those of the wooden tie, though the weight is about 700 pounds, or three times as heavy as a wooden tie. This great weight, with the asphalt surface resting on the ballast is calculated to reduce creeping to a minimum.

It is hoped that the experiments which are being made with the steel tie will meet the expectations of engineers. This would mean that the wooden tie will eventually be replaced by steel, in which event the drain on our forests will be considerably reduced. Few railroad officials, however, think that wooden ties will ever be entirely replaced by metal.

Turner Interlocking Signal

THE interlocking system is intended to protect points at which two railroads cross each other, giving automatically or manually a clear signal to the first train entering one of the arms of the crossing, and danger signals to any other trains coming on the other arms of the crossing, together with an open derailing switch to insure safety should the signal be disregarded. The principle upon which interlocking crossings are operated is to allow the first comer to proceed and require others to

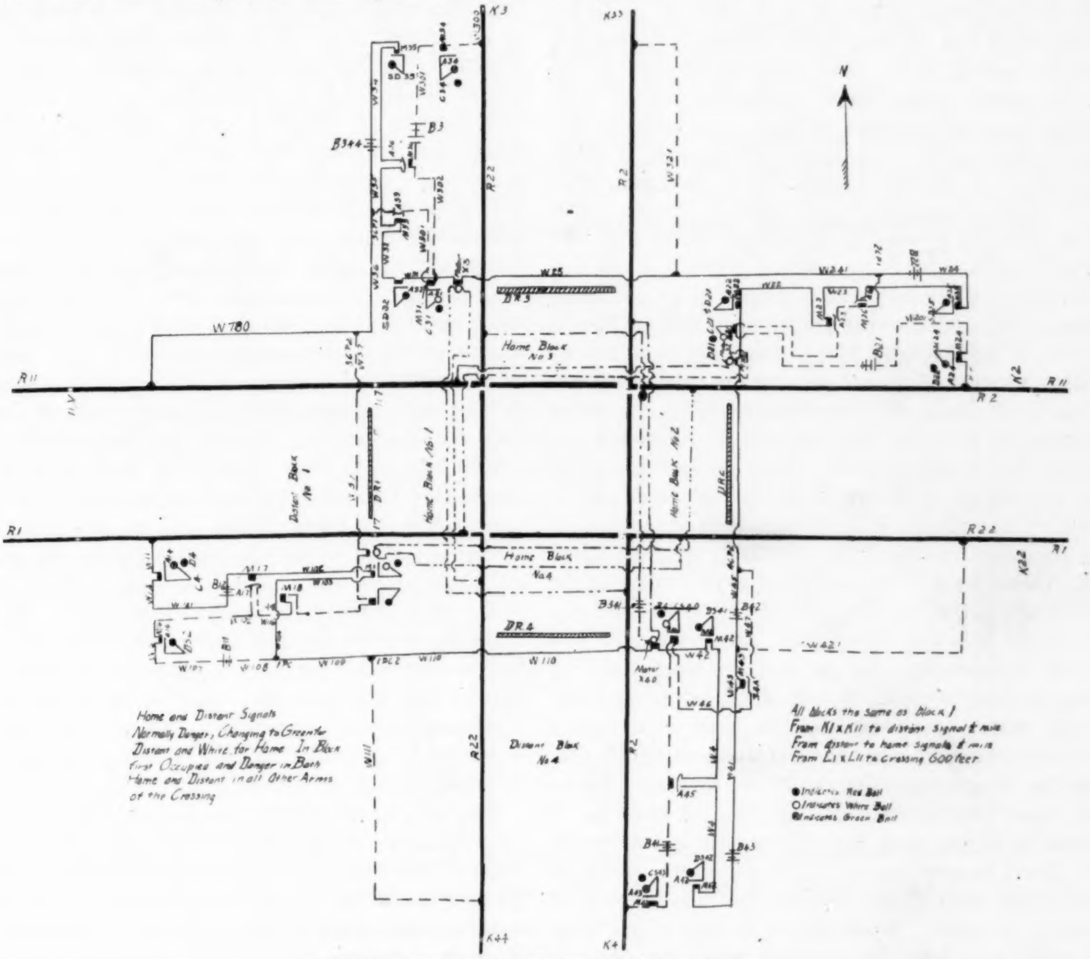


DIAGRAM OF WIRING—TURNER INTERLOCKING SYSTEM.

stop until the first train in has passed the crossing. What are known as "Distant" signals are placed at varying distances from the crossing, are used as a precaution. Near the crossing at about 350 to 450 feet therefrom are the "Home" signals with a derailing switch, it being naturally better to derail the train before getting to the crossing rather than to let the trains collide on the crossing.

The system used today is that of a mechanical device operated manually from a signal tower at the crossing. This device consists of a series of levers which are so arranged as to give the clear signal to the train desired and danger signals to trains coming on the other tracks, with open derailing switches on the tracks protected by danger signals, the mechanism being so "interlocked" that two clear signals cannot be given at the same time.

Besides the first cost, which is large, these signals require the constant attention of signalmen, night and day, who are paid about $50 per month, making the cost of operation about $1,200 per year, besides the cost of maintenance. In some cases they have electric power for the distant signals, controlled by the levers of the mechanical plant.

Recently a very ingenious electrical automatic system has been devised and is known as the Turner Interlocking Signal system. The Turner system is designed to eliminate the chance of human fallibility and does away with the need of signalmen.

By referring to the accompanying diagram the different circuits can be traced. Supposing a train enters distant block No. 1 from the west. The current starts from battery B 12, magnetizes magnet M 17, which attracts armature A 17 in the danger signal circuit of block No. 1, opening that circuit. It then follows wire W 102 to magnet M 1, energizing that magnet and attracting armature A 1, which clears the signal in Home Block No. 1.

It then follows wires W 103, W 104, W 109, W 110 to derailing motor X 40 which opens derailing switch DR 4. It then follows wire W 42 and energizes magnet M 42 which attracts armature A 42, placing signal DS 41 at danger. It then follows wire W 4 through magnet which attracts the armature in the clear signal circuit, thus opening that circuit. It then energizes magnet M 42 which attracts armature A 42 and sets danger DS 42. It then passes through battery B 43, over wires W 41 through magnet M 43 which attracts the armature in the clear signal circuit, thus opening that circuit. Thence to wire W 43 through battery B 42, to wire W 45 to derailing motor X 2, which opens derail DR 2. It then follows to magnet M 22 which attracts armature A 22, showing danger signal SD 21. Thence by wire W 22 to magnet M 23 which attracts armature A 23, opening clear signal circuit in block No. 2. Thence by wire W 23 to armature A 26, thence to magnet M 25, energizing same which attracts armature A 25, showing danger signal SD 25. Thence by wire W 24 through battery B 22 and wires W 241 and W 25 to derailing motor X 3, opening derail DR 3. Thence by wire to magnet M 32, attracting armature A 32 and showing danger signal SD 32. Thence by wire W 32 to magnet M 33, energizing same and attracting armature A 33 and opening the clear signal circuit in Block No. 3. Thence to magnet M 35 energizing the same and attracting armature and setting danger signal SD 35. Thence by wire W 34 through battery B 344, wire W 35, W 36 and W 780 through front part of wheels of train thence W 11 to magnet M 14, energizing and attracting armature A 14 and setting the clear signal C 4. Thence by wire 101 to Battery B 12 completing the circuit. It will be seen that this circuit gives clear signals to the train first entering the distant block of any arm of the crossing. For convenience, block No. 1 is shown as being occupied by a train. It will be seen that in both distant and home block No. 1 the clear signals are shown, while all other arms of the crossing are protected by danger signals in the distant and home blocks with open derailing switches. As long as train No. 1 remains in distant block No. 1, these signals will remain set. It will be seen that derail DR 2 has been opened so that if this train should proceed over the crossing it would be derailed. When the front rails of the train or engine pass over the insulated joints 17 and 117 normally closed track circuit in home block No. 1 is dissipated. Magnet M 78 loses its power of attraction and ceases to attract armature A 78, allowing it to fall in place. This completes the circuit which closes the derail DR 2. This current is negative to the current that opened the derail, and causes the motor to reverse itself, thus closing the derail. It will be seen that the train shown in distant block No. 1 in passing over the crossing has a closed derail and clear track. This action of the system is automatic and acts in the same manner whatever arm of the crossing is first occupied by a train.

A train entering any of the other blocks on arms of the crossing can be traced the same way as block No. 1.

The derailing motor is so arranged as to lock the derail.

The train is shown in block No. 1 merely as an example, and its movement is governed the same as the system used today. The first train to enter any arm of the crossing will get clear signals and closed derailing switches, while all other arms are protected by danger signals and open derails until the train shall have passed out of the danger zone.

Motor Car Versus Hand Car

THE subject of motor cars versus hand cars is one receiving considerable attention from maintenance of way officials as well as from the manufacturers of such supplies. The success which has attended the introduction of gasoline motors in propelling inspection cars naturally opened the subject of motor section cars and motor bridge cars—although the experience has been limited to a few roads, the results have been very encouraging, and it is quite probable that the motor car will gradually supersede the clumsy and slow hand car. There are so many things in favor of the motor car that it seems almost unnecessary to enumerate them. Consider the ordinary hand car being propelled by a gang of four men from one end of the section to the other, say a distance of six miles; this consumes under favorable conditions at least thirty minutes, and when the men get off the car they are tired and out of wind and really need a rest before they go to work. This for a gang of four men amounts to four hours per day, and at fifteen cents per hour makes sixty cents per day. On the other hand, if a motor car is used the time consumed in going and coming can easily be cut down one-half, making a net saving of thirty cents per day on the travelling alone. But the work the men can do after a ride which causes no exertion on their part is certainly of a different character than that of men who have been tired out by a half hour's strenuous pumping of a hand car; likewise these men will work steady up to quitting time, knowing that they will be transported home quickly by their motor car.

This is, however, not the only favorable feature of this class of cars. It enables the railway companies to lengthen out their sections; it may be said they may double their length, and thus save the salaries of a number of foremen; they might be able to pay better salaries to the foremen so retained, and yet the aggregate cost of maintenance would be less.

There would, no doubt, arise the necessity of making provision for keeping such cars in good running order, and a man specially qualified to look after the cars on one division would have to be employed, but even doing this would still leave a handsome profit on the side of the motor car as against the ordinary hand car.

The only thing which makes railway companies hesitate at the present time is the high prices which manufacturers are asking for these cars. That the motor cars can do the work has been proven to the satisfaction of all interested, and it is merely a question of time until they will displace the old style hand cars. The use of these cars will be accelerated as the machines are made more perfect and prices lowered.

Cost of Steam Shovel Work

By John C. Sesser, Engineer of Construction, C., B. & Q. Ry.

From Bulletin No. 81 of the American Railway Engineering and Maintenance of Way Association.

THE steam shovel has made it possible, in the rebuilding of the railroads throughout the country, to do grading which heretofore was impracticable.

The railroads are doing or organizing to do their steam-shovel work with company forces and equipment. That they are better fitted and able to do this work from 25 to 30 per cent. cheaper than the price for which it could be contracted is a fact without question.

In view of the great amount of re-alinement and grade reduction work now being done, it is not surprising that the railroad companies have gone into this work to quite an extent and thus effected a saving which a well-managed road cannot afford to overlook.

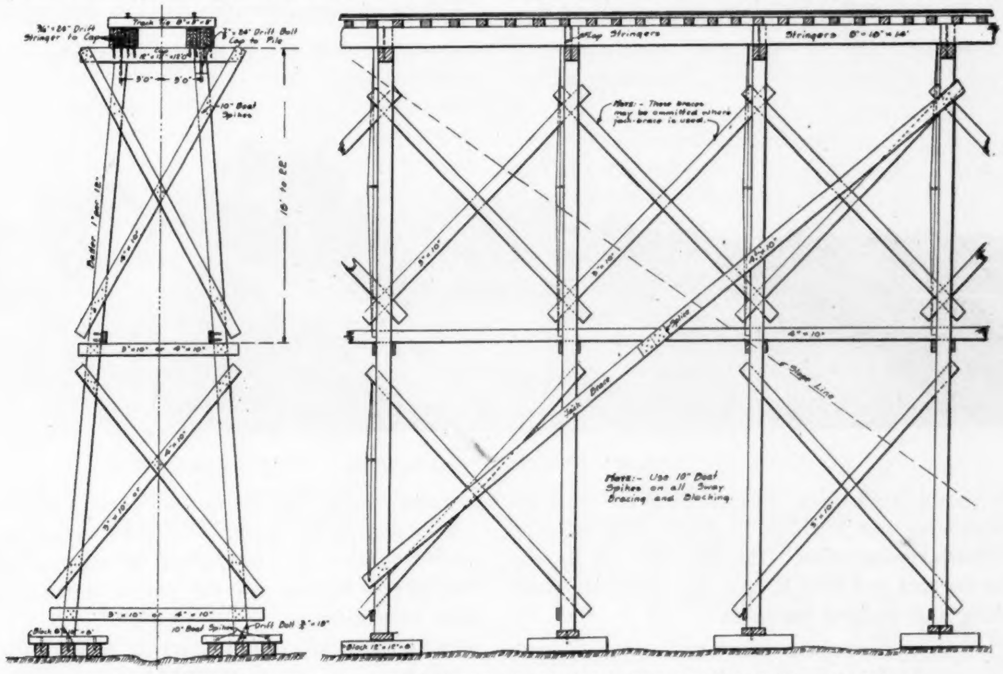
Among the various jobs of grade reduction work which were done on the Burlington System during the season of 1906, there were two on the Beardstown-to-Centralia Division, known as the Big Shoal and Little Shoal Cut-off, respectively.

BIG SHOAL CUT-OFF.

The Big Shoal Cut-off was a change of alinement and grades between Sorento and Reno, Ill. On this cut-off there were 318,711 cubic yards of earth to be moved, of which 251,711 cubic yards were steam-shovel work. Bids were asked of the larger contractors of the country for this grading, and, while their prices per yard were reasonable, they were higher than that for which the company could do the work. Consequently it was decided that the company should do the work themselves, with their own forces and equipment.

A record of the costs of this work will possibly be of interest, as would also a comparison of the cost, to the company, for work done by its own forces with that for which the contractor would have done the same.

On this work two temporary trestles were built, having a total length of 2,961 ft. and an average height of 40 ft. The material for the embankment was hauled from the north, an average distance of one and one-half miles. The average depth of cut was 15 ft. The material handled was clay. On account of numerous springs encountered, both material and steam-shovel pit were very wet, which delayed this work to some extent. At times the clay would leave the dipper in chunks as large as the dipper itself. This made the dumping of cars from the high trestle rather dangerous, and necessitated the locking of the cars to the trestle before they were dumped.



SKETCH OF TEMPORARY TRESTLE USED ON WORK AT BIG AND LITTLE SHOAL CREEKS—C. B. & Q. RY.

THE CAMP.

The work being entirely separated from the main line, where boarding cars would have been impracticable, bunk houses were built for the men employed on this work. These houses were constructed out of the ordinary rough lumber, matched lumber being used for the flooring only. The camp consisted of a bunk house for the laborers, cook house, bunk house for the shovel, engine, and bridgemen, commissary, bath, and oil house. The bunk house for the laborers was 16x62x10 ft. high. This building accommodated seventy-two men. One single row of bunks was built on each side of the building, and a double row through the center. These bunks were 6 x 2 ft. 6 in. wide. This left an aisle of 3 ft. 6 in., which was ample.

The bunk house for the engine, bridge and shovelmen was 16x56x10 ft. high. This building was divided into three compartments, so as to keep each class of men by themselves. Bunks were built to accommodate twenty shovelmen, sixteen bridgemen and twenty trainmen.

The cook house was 16x110x10 ft. high, with the kitchen (16x24 ft.), in the center. The dining rooms were at either end of the building. The room for the laborers, at one end, would accommodate eighty men, and the room at the other end sixty men, which was used by the shovel, train, and bridgemen only.

The commissary was a small building, 18x24 ft., in which was kept supplies for the men, kitchen, etc.

Board was furnished the men for $3.75 per week by the boarding contractor for the System.

WATER SUPPLY.

Water was supplied to the shovel by a two-inch pipe line, laid on the ground outside of the digging line. At every hundred feet this pipe line had a "T" with a tap, and by means of a long rubber hose water could be supplied the shovel at all times, thus avoiding the usual delay of siphoning water which, in double-shift work, is an item worth consideration. This pipe line was also extended to the cook and bunk houses, thus supplying water for cooking and washing purposes.

TEMPORARY TRESTLE.

The temporary trestle built was designed to carry a loaded train of five-yard dump cars before being filled, and the engine in service only after the trestle had been filled. Each bent consisted of two softwood piles, bracing and cap. Second-hand material was used throughout with the exception of the bracing. Two 8x16 in. stringers were used per span, which were built thirteen feet. The stringers were recovered, the balance of the material buried in the embankment.

From the results obtained from a number of trestles of this kind that the writer has had to build, the following conclusions have been reached:

For trestles from 20 to 60 ft. in height, the cost per yard of embankment for temporary trestle should be approximately the same for all heights between these limits.

Except as an approach to higher trestle, it is not economy to build trestles under sixteen feet in height.

On all trestle work over thirty feet in height a scab should be placed on cap and pile to prevent cap turning. It seems to be the better practice to place the scab on the side toward the filling.

On all trestles over thirty feet in height longitudinal bracing should be placed on the side of the pile toward center of trestle.

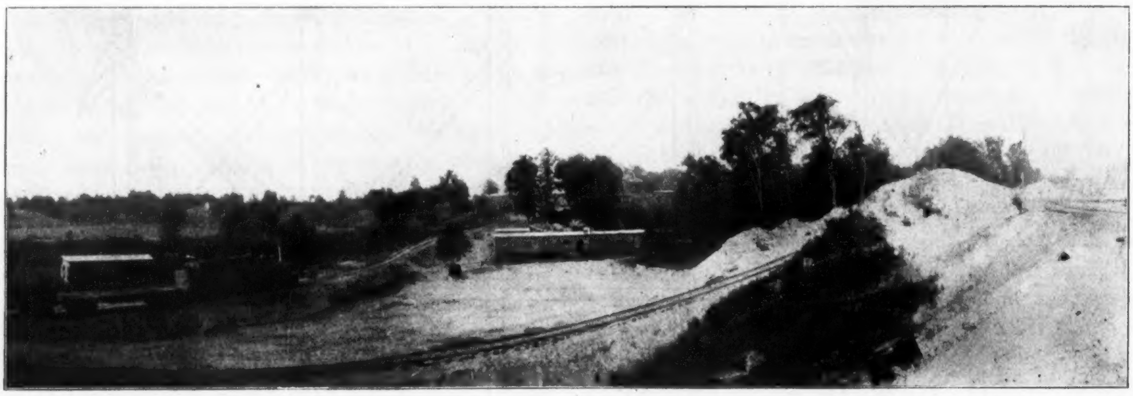
When necessary to use "Jack" braces, they should be built toward the bank that is being filled, so as to put the members in tension rather than compression.

Sway braces should be placed on the side of the bent toward which the material is being dumped.

If possible to avoid it, soft ties should not be used on high trestles.

The following reports show the cost to the railway company of this steam-shovel work. In these reports the cost of each kind of work in connection with the steam shovel grading is given. Where equipment of this kind is used, it is taken as a fair average.

Comparing these two reports as to final cost, it is interesting to note that the cost per yard in place on either job is precisely the same. While the equipment and organization were, in a way, about the same at both places, the material handled and the general layout of the work were very different.



LITTLE SHOAL CAMP—C. B. & Q. RY.

FINAL REPORT, BIG SHOAL STEAM SHOVEL WORK.

EQUIPMENT.

1 65-ton Bucyrus Steam Shovel.
2 Switch Engines (Class "E"), weight on drivers, 30 tons.
43 Five-yard dump cars.
1 Jordan spreader.

(All yardage, cross-section measurements.)

GENERAL.

Date shovel commenced work	April 27
Date shovel completed work	Nov. 2
Date shovel commenced night shift	June 20
Date shovel commenced night shift	Oct. 26
No. of days steam shovel on work	190
No. of nights steam shovel on work	129
Total	319

Total days worked by steam shovel	140
Total nights worked by steam shovel	88
Total days worked by steam shovel (10-hour shift called a day)	228
Shovel laid up due to rain and Sundays (shifts)	57
Shovel delayed on account of moving shovel and shovel failure (shifts)	23
Waiting for grading of temporary track (shifts)	11
Percentage of days of shovel service shovel delayed	25 per cent
Total car output, day shift	47,862
Total car output, night shift	27,377
Total	75,239
Cubic yards handled, day shift	160,121
Cubic yards handled, night shift	91,590
Total	251,711
Cubic yards per car	3.35
Cubic yards per day (10-hour shift called a day)	1,104
Percentage of night shift output to day shift output	84 per cent
Length of haul, average distance	1½ miles
Material, where dumped	Temporary trestle
Kind of material	Wet clay
Condition of pit	Wet

COST.

EQUIPMENT, ETC.

1 Second-hand steam shovel, value	$5,000.00	
Depreciation, 10 per cent.		$ 500.00
2 Second-hand Class "E" switch engines	$4,400.00	
Depreciation, 5 per cent.		220.00
43 Second-hand five-yard dump cars	$5,052.50	
Depreciation, 10 per cent		505.25
1 Jordan spreader	$1,800.00	
Depreciation, 5 per cent.		90.00
Total		$1,315.25

BUNK HOUSES.

Net cost of material	$ 757.18
Net cost of labor	387.68
Total	$1,144.86

WATER SUPPLY.

Net cost of material	$ 191.43
Net cost of labor	81.17
Total	$ 272.60
Grand total cost of equipment used	2,732.71

COST STEAM SHOVEL SERVICE—LABOR.

Total cost steam shovel service	$ 6,228.54
Cost per cubic yard	.024
Total cost engine service (2 engines)	6,417.33
Total cost per yard	.026
Total cost car repairing and blacksmithing	771.47
Total cost per yard	.003
Total cost of lighting for night work	184.62
Total cost per yard	.001
Total cost dumping cars	4,265.51
Total cost per yard	.017
Total cost all labor steam shovel service	17,867.47
Total cost per yard	.071

COST OF SHOVEL, ENGINES AND CAR SUPPLIES.

369 gals. valve oil used, at 50c per gal.	$ 184.50
500 gals. black oil used, at 18c per gal.	90.00
51 gals. signal oil used, at 34c per gal.	17.34
4,946 gals. kerosene used, at 10c per gal.	494.60
754 gals. gasoline used, at 17c per gal.	128.18
1,040 tons coal used by shovel, at $1.48 per ton	1,539.20
1,339 tons coals used by engines, at $1.48 per ton	1,981.70
800 pounds waste used, at 6c per lb.	48.00
Total cost of supplies	$ 4,483.52
Total cost per yard	.018
Grand total cost shovel work (labor)	$17,867.47
Grand total cost shovel work (supplies)	4,483.52
Grand total cost	$22,350.99
Per yard	.089

TEMPORARY TRESTLE.

Total cost of trestle	$ 9,007.80
Length of trestle (feet)	2,961
Average height	40
Cost per linear foot (labor)	$ 1.30
Cost per linear foot (material)	1.74
Total cost per linear foot	3.04
Total cost per yard	.036

(Cost includes labor for removing stringers.)

TRACK WORK..

Total cost of all labor	$11,582.31
Total cost per yard	.046
Value of track supplies	7,338.76
Depreciation and actual cost of work	856.11
Total cost of track work	12,438.42
Total cost per yard for all track work	.049

SUMMARY OF COST.

	Total.	Per yard.
Equipment, etc	$ 2,732.71	$0.010
Steam shovel service	22,350.99	.089
Temporary trestle	9,007.80	.036
Track and track work	12,438.42	.050
Supervision and engineering	610.38	.002
Total	$47,140.30	$0.187

OUTLINE OF FORCE.

DAY SHIFT.

1 General Foreman, at	$118.50 per month
1 Steam Shovel Engineer, at	125.00 per month
1 Steam Shovel Cranesman, at	90.00 per month
1 Steam Shovel Fireman, at	55.00 per month
6 Steam Shovel Pitmen, at	19c per hour
1 Conductor, at	103.50 per month
2 Brakemen, at	69.00 per month
2 Enginemen, at	4.00 per day
2 Firemen, at	2.40 per day

1 Track Foreman, at	75.00 per month
1 Assistant Foreman, at	55.00 per month
10 Laborers dumping cars	16c per hour
38 Laborers on track, at	16c per hour
1 Watchman, at	45.00 per month
1 Timekeeper, at	45.00 per month
1 Pumper, at	45.00 per month

NIGHT SHIFT.

1 Steam Shovel Engineer, at	$125.00 per month
1 Steam Shovel Cranesman, at	90.00 per month
1 Steam Shovel Fireman, at	55.00 per month
6 Steam Shovel Pitmen, at	20c per hour
1 Conductor, at	103.50 per month
2 Brakemen, at	69.00 per month
2 Enginemen, at	4.00 per day
2 Firemen, at	2.40 per day
1 Assistant Track Foreman, at	55.00 per month
8 Laborers, at	1.75 per day
1 Watchman, at	1.75 per day
1 Lightman, at	1.75 per day
1 Pumper, at	45.00 per month

COST PER DAY.

LITTLE SHOAL TRESTLE—C. B. & Q. RY.

	Labor.	Supplies.	Total.
General Foreman	$ 2.28		$ 2.28
Steam shovel service	22.09	$ 5.50	27.59
Engine service	22.08	9.00	31.08
Car repairing	4.40		4.40
Dumping cars	19.00		19.00
Track foreman	2.88		2.88
Assistant track foreman	2.11		2.11
Track work	62.70		62.70
Timekeeper	1.73		1.73
Pumper	1.73	.65	2.38
Watchman	1.60		1.60
Total	$142.60	$15.15	$157.75

COST PER NIGHT.

	Labor.	Supplies.	Total.
Steam shovel supplies	$ 22.69	$ 5.50	$ 28.19
Engine service	22.08	9.00	31.08
Assistant foreman	2.11		2.11
Dumping cars	14.00		14.00
Lighting	1.75	2.34	4.09
Pumping	1.73	.70	2.43
Watching	1.75		1.75
Total	$ 66.11	$17.54	$ 83.65
Total day and night	$208.71	$32.69	$241.40

PROGRESS.

Month.	Day. Yards.	Night. Yards.	Total Yards.
May	30,766	......	30,766
June	26,744	8,292	35,036
July	33,874	25,324	59,198
August	34,478	28,722	63,200
September	19,200	14,900	34,100
October	17,430	11,981	29,411
Totals	162,492	89,219	251,711

(All yardage cross-section measurements.).

COMMENT.

A comparative statement of the work done by company forces with that for which it could be contracted, is as follows:

If done by contractor with steam shovel outfit:

251,711 cu. yds. earth, at 26c	$65,444.86
Actual cost to the company	47,140.30
Saving	$18,304.56

The factor of time would also have had to be considered had the work been done this way.

It is the opinion of the writer that the cost of this work could have been materially reduced had twelve-yard dump cars had been used instead of the five-yard. In the judgment of the writer, the five-yard car is too light in construction for the service required in handling heavy material, such as was handled on this work.

On account of complying with the enginemen's schedule, there was expended on this work $431.20, for which we received no service. This is about 10 per cent. of the cost of the supplies.

The cost of this work to the company could have been reduced somewhat if we had not been handicapped in being governed by schedules, and also if we had had the

same freedom in the handling of labor, supplies and commissary as does the general contractor.

LITTLE SHOAL CUT-OFF.

The Little Shoal Cut-off was a change of alinement and grades between Ayers and Durley, Ill. On this work there were handled 188,240 cubic yards of material.

A temporary trestle was built, having a total length of 2,142 ft., and an average height of 35 ft.

Material for the embankment was hauled an average distance of one-half mile.

The material handled was about 40 per cent. hardpan, it being about as hard a material as the shovel could dig without resorting to blasting.

On this work both shovel and engines were handled over 6 per cent. grades and 16-degree curves very easily.

The cost of this work to the company is given herewith.

FINAL REPORT, LITTLE SHOAL STEAM SHOVEL WORK.

EQUIPMENT.

1 65-ton Bucyrus Steam Shovel.

2 Switch Engines (Class "E"), weight on drivers, 30 tons.

36 Five-yard dump cars.

1 Jordan spreader.

GENERAL.

Date shovel commenced work	May 21
Date shovel completed work	Sept. 30
Date shovel commenced night shift	May 22
Date shovel completed night shift	Sept. 30
No. of days steam shovel on work	133
No. of nights steam shovel on work	132
Total	265
Total days worked by steam shovel	96
Total nights worked by steam shovel	103
Total days worked by steam shovel (10-hour shift called a day)	199
Shovel laid up due to rains and Sundays (days)	52
Shovel delayed on account of moving shovel and shovel failure (days)	14
Percentage of the 199 days of shovel service shovel delayed, 16 per cent.	
Total car output, day shift	29,774
Total car output, night shift	23,116
Total	52,890
Cubic yards handled, day shift	105,818
Cubic yards handled, night shift	82,422
Total	188,240
Cubic yards per car	3.56
Cubic yards per day (10-hour shift called a day)	946
Percentage of night-shift output to day-shift output	78 per cent.
Length of haul, average distance	½ mile
Material, where dumped	Temporary trestle
Kind of material	39 per cent. hard-pan and clay
Condition of pit	Wet

COST.

EQUIPMENT, ETC.

1 Second-hand steam shovel, value	$5,000.00	
Depreciation, 10 per cent.		$ 500.00
2 Second-hand Class "E" switch engines	$4,400.00	
Depreciation, 5 per cent.		220.00
36 Second-hand five-yard dump cars	$4,230.00	
Depreciation, 10 per cent.		423.00
1 Jordan spreader	$1,800.00	
Depreciation, 5 per cent.		90.00
Total		$1,233.00
Bunk Houses:		
Net cost of material	$757.18	
Net cost of labor	309.58	
Total		$1,066.76
Water Service:		
Net cost of material	$311.20	
Net cost of labor	299.97	
Total		611.17

Grand Total Cost of Equipment	$2,910.93
Total cost of steam shovel service	$ 5,359.66
Total cost per yard	.028
Total cost engine service (2 engines)	5,303.25
Total cost per yard	.028
Total cost car repairing and blacksmithing	513.89
Total cost per yard	.003
Total cost of lighting for night work	203.34
Total cost per yard	.001
Total cost dumping cars	3,148.73
Total cost per yard	.017
Total cost all labor steam shovel service	14,528.87
Total cost per yard	.077

COST OF SHOVEL, ENGINE AND CAR SUPPLIES.

168 gals. Valve oil used, at 50c per gal.	$ 84.00
600 gals. Black oil, at 18c per gal.	108.00
78 gals. Signal oil, at 34c per gal.	26.52
3,660 gals. Kerosene, at 10c per gal.	366.00
858 gals. Gasoline, at 17c per gal.	145.86
800 lbs. waste, at 6c per lb.	48.00
1,086 tons coal for steam shovel, at $1.50 per ton	1,629.00
800 tons coal for engines, at $1.50 per ton	1,200.00
	$3,607.38
Per cubic yard	.019
Grand Total Cost of Shovel Work (Labor)	$14,528.87
Grand Total Cost of Shovel Work (Supplies)	3,607.38
Total	$18,136.25
Total Cost per yard	.096

TEMPORARY TRESTLE.

Total cost of trestle	$5,853.08
Average length of trestle (feet)	2,142
Average height of trestle (feet)	35
Cost per linear foot (Labor)	1.22

Cost per linear foot (Material)	1.51
TOTAL COST per linear foot	2.73
TOTAL COST per yard	$.031

TRACK WORK.

Total cost of all labor	$6,673.36
Total cost per yard	.035
Value of track supplies	6,479.58
Depreciation and actual cost of work	1,143.95
Total cost of track work	7,817.31
Total cost per yard for all track work	.042

SUMMARY OF COST.

	Total.	Per Yard.
Equipment	$ 2,910.93	$0.015
Steam shovel service	18,136.25	.096
Temporary trestle	5,853.08	.031
Track and track work	7,817.31	.042
Supervision and engineering	487.34	.003
TOTAL	$35,204.91	$0.187

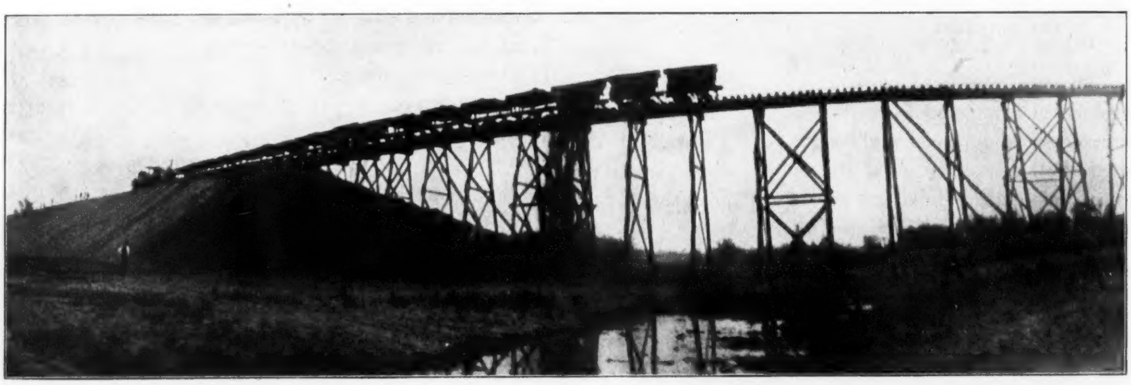
OUTLINE OF FORCE.

DAY SHIFT.

1 General Foreman, at	$118.50 per month
1 Steam Shovel Engineer, at	125.00 per month
1 Steam Shovel Cranesman, at	90.00 per month
1 Steam Shovel Fireman, at	55.00 per month
6 Steam Shovel Pitmen, at	19c per hour
1 Conductor, at	103.50 per month
2 Brakemen, at	69.00 per month
2 Enginemen, at	4.00 per day
2 Firemen, at	2.40 per day
1 Pumper, at	45.00 per month
1 Track Foreman, at	75.00 per month
1 Assistant Foreman, at	55.00 per month
10 Laborers dumping cars	16c per hour
38 Laborers on track	16c per hour
1 Watchman, at	45.00 per month
1 Timekeeper, at	45.00 per month

NIGHT SHIFT.

1 Steam Shovel Engineer, at	$125.00 per month
1 Steam Shovel Cranesman, at	90.00 per month
1 Steam Shovel Fireman, at	55.00 per month
6 Steam Shovel Pitmen, at	20c per hour
1 Conductor, at	103.50 per month
2 Brakemen, at	60.00 per month
2 Enginemen, at	4.00 per day
2 Firemen, at	2.40 per day
1 Assistant Track Foreman, at	55.00 per month
8 Laborers, at	1.75 per night
1 Watchman, at	1.75 per night
1 Lightman, at	1.75 per night
1 Pumper, at	45.00 per month



LITTLE SHOAL TRESTLE—C. B. & Q. RY.

COST PER DAY.

	Labor.	Supplies.	Total.
General Foreman	$ 2.28		$ 2.28
Steam shovel service	22.09	$ 5.50	27.59
Engine service	22.08	9.00	31.08
Car repairing	4.40		4.40
Dumping cars	19.00		19.00
Track Foreman	2.88		2.88
Assistant Track Foreman	2.11		2.11
Track work	62.70		62.70
Timekeeper	1.73		1.73
Watching	1.60		1.60
Pumper	1.73	.65	2.38
Total	$142.60	$15.15	$157.75

COST PER NIGHT.

	Labor.	Supplies.	Total.
Steam shovel service	$ 22.69	$ 5.50	$ 28.19
Engine service	22.08	9.00	31.08
Assistant Foreman	2.11		2.11
Dumping cars	14.00		14.00
Lighting	1.75	2.34	4.09
Pumping	1.73	.70	2.43
Watching	1.75		1.75
Total	$ 66.11	$17.54	$ 83.65
Total night and day	$208.71	$32.69	$241.40

PROGRESS.

Month.	Day. Yards.	Night. Yards.	Total Yards.
May	9,724	5,251	14,975
June	32,268	25,364	57,632
July	25,778	19,883	45,661
August	24,018	20,602	44,620
September	14,077	11,275	25,352
Totals	105,865	82,375	188,240

(All yardage cross-section measurements.)

Total yardage handled, 188,240, of which 39 per cent., or 72,900 cubic yards would classify as loose rock, it being as hard a digging material as the shovel could stand without resort to blasting.

If done by contractor with steam shovel outfit:

188,240 cu. yds. at 26c.	$48.942.40
Actual cost to company	35,204.91
SAVING	$13,737.49

It is a certainty, had this work been let to a contractor, it would have been necessary to make some allowance on account of hard material, which would make the saving considerably more. Also, there is the factor of free transportation and freight, which would also be given them.

This cost includes all items of freight, supplies, labor and any others that are possible to include that should be charged to this work. It has been the intention in estimating same to get as close an estimate of actual cost to the company as possible.

SUMMARY.

The limits to which a shovel will work is a most important consideration in planning and estimating work of this kind. It is not economy to work the shovel to its extreme limits in lift and reach. The shovel used on this work, at times, loaded the five-yard cars on a loading track which was 9 ft. 2 in. higher than the shovel track, with the track centers 22 ft. Loading at such height is very slow work and is liable to wreck the cars badly on account of the lack of clearance for the return of the dipper after emptying.

When there is more than one cut to be made and where time is the all-important factor, 7 ft. difference in elevation between the shovel and loading tracks allows rapid work and gives better results.

In laying out steam-shovel work considerable can be saved at times by taking advantage of the natural conditions of the work as they exist. The track arrangement and the future track arrangements as the work progresses is a thing that is oftentimes neglected and causes serious delays to the shovel. On very few jobs has the writer seen the shovels work to their capacity on account of poor track arrangement and the consequent inability to keep the cars to the shovel. One must have good running track over the entire work. With good track and proper arrangement, ideal conditions for a maximum shovel output are obtained.

Freight Yard on the Pennsylvania R. R.

WINTER risks of delay on the main line of the Pennsylvania Railroad east of Pittsburgh have been largely reduced now that the company's improvements at Hollidaysburg are about completed. At this point a vast freight yard with fifty-five miles of track, has been established in connection with the Pennsylvania's new low grade freight line. If the main line at this mountain trouble-spot should at any time be obstructed, it will be possible to divert all traffic without loss of time by way of Hollidaysburg.

While this is the practical advantage the public gains by the improvement, interest is also centered at this point because it is the place where canal boats, in years gone by, were taken out of the old canal, transferred to cars, and hauled up the mountains by the old Portage Railroad. It was then the scene of great bustle.

The increasing volume of freight business in the past few years made it necessary to relieve the main line, and for five or six years, the low grade freight line has been building for this purpose. For its entire length the maximum grade is three-tenths of one per cent. At West Morrisville, near Trenton, the low grade line joins the main line to Philadelphia and Jersey City. "Runs" on the low grade line are arranged from Pitcairn, just outside of Pittsburgh; from Hollidaysburg to Enola, near Harrisburg, and from Enola to West Morrisville.

In the Hollidaysburg yards there are engine accommodations, including a 24-stall engine house, coal wharf, two 75-foot turntables, and four ashpits with pneumatic hoists and traveling cranes. There are also shop yards (for repairing cars), machine shop, power house, store house, oil house, planing mill and lumber sheds.

Consumption of Railroad Ties

THE American railroad companies in 1905 purchased over ninety-one million wooden ties. The yearly increase of railway mileage and the constant decrease of suitable timber for the manufacture of railway ties will soon compel the railroad companies to use either steel or concrete ties. While the steel tie answers very well so far as strength is concerned, it lacks durability, while the concrete tie is absolutely durable. The tendency in steel is upward, while concrete products are declining in price. The future material for ties points unmistakably to concrete. Assuming that ninety-one million concrete ties would be required each year, and that one barrel of cement would be required to manufacture five ties, no less than 18,200,000 barrels of cement would be consumed in the production of ninety-one million concrete ties. This is nearly one-half of the present output of Portland cement in this country.—*Cement and Engineering News.*

Actual Work in the Field for Students

Students in the civil engineering department of the University of Illinois are taking the profile of over 100 miles of railroad track, the work being done for Professor Schmidt of the department of railway engineering, to form part of the data for future dynamometer car tests. The level parties at present, three in number are under the direction of Assistant Professor Brooks. One party is working west on the interurban line from Danville, Ill., one is running east from Champaign on the same line; and a third has been collecting data from Champaign south, along the Illinois Central R. R. The profiles are to be of the Illinois Central from Gilman to Mattoon and of the interurban road from Champaign to Danville. The features of the work as specified in the directions to parties include the use of a 300-ft. station unit.

Third Convention of the National Association of Cement Users

THE third annual convention of the National Association of Cement Users, was held in Chicago, January 7th to 12th. The exhibits were displayed in the Seventh Regiment Armory, while all papers were read in the Auditorium Hotel. This convention was one of the most successful that this society has held. The attendance was exceptionally large and the work of the committees is to be commended.

It is intended to give an abstract of the different papers read and take them up in the order of their delivery.

A paper on "Cement Side Walks," by Mr. A. Moyer, of New York, brings out forcibly the selection of material, mixing, placing and tamping, durability and neatness of cement walks, as well as a list of specifications of material to be used in side walks.

The report of the "Committee on Side Walks and Floors," was given by Mr. J. L. Stanley, Ashtabula, Ohio. The subject of foundations of side walks, floors, etc., was well treated, especially along the lines of embankment, width and thickness of walks, lines and grades to be given by engineers, etc.

Prof. W. K. Hatt, of Purdue University, LaFayette, Ind., delivered a paper on "Mechanics of Reinforced Concrete," which brought out the idea of the necessity of correct theory and design in expert supervision in construction of reinforced concrete. In summing up this well treated subject he makes the following statements:

(a) Concrete is durable and fire-proof when made of the proper aggregate.

(b) The strength of combinations of steel and concrete may be calculated with a sufficiently close degree of accuracy.

(c) Shapely and beautiful structures may be built of this material. It is particularly adapted for mill buildings, because of the absence of vibrations, which are induced in the ordinary type of mill buildings by the rapidly revolving machinery.

(d) The cost of properly designed reinforced concrete building, where wooden forms are used to an advantage, is said not to exceed more than five or ten per cent of the cost of the mill building of the ordinary type with brick walls and wooden beams of the so-called "slow burning" construction, provided that the concrete may be laid, as at present, by unskilled labor.

A paper on "Forms of Concrete Construction," was read by Mr. S. E. Thompson, which brought out the matter of calculating for safe concrete construction and cites many instances where this has not been done and the failures that have been caused by not doing so. He also enumerated several failures which are in many cases directly due to the following:

(a) Imperfect design, especially through neglect of essential details in locating the reinforcing metal, and through the adoption of too low a factor of safety.

(b) Poor materials; such as cement which does not properly set up, or sand which is too fine or which has an excess of clay, loam or other impurities.

(c) Faulty construction; from improper proportioning, mixing or placing, or too early removal of forms.

(d) Weak forms.

Mr. W. B. Fuller delivered a paper on "Simple Tests for Determining Value of Materials for Use in Mortar and Concrete," in which he gives a list of experiments recently performed, giving the different proportions of concrete and their modulus of rupture in pounds per square inch. In investigating this subject over a term of years it has been found that there is one combination of any given sand and stone, which with a given percentage of cement makes the strongest concrete. This is the proportion which also gives the densest concrete, that is, the concrete which contains the least percentage of voids, or otherwise that which weighs most per cubic foot. In making a summary of his paper and as a guide for obtaining the best concrete, he makes the following statements:

(a) The stone should all be of one size or should be evenly graded from fine to coarse, as an excessive amount of the fine or middle sizes is very harmful to strength.

(b) All of the fine material smaller in diameter than one-tenth of the diameter of the largest stone should be screened out from the stone.

(c) The diameter of the largest grains of sand should not exceed one-tenth of the diameter of the largest stone.

(d) The coarser the stone used the coarser the sand must be, and the stronger, more dense and watertight the properly proportioned work becomes.

(e) When small stones only are used the sand must be fine and a larger proportion of cement must be used to obtain equal strength.

Mr. E. S. Larned, representing the committee on "Testing Cement and Cement Products," delivered a paper recommending that it be declared the sense of this committee that all cement used in reinforced concrete construction should be high grade Portland cement, meeting all the requirements and tests of the American Society for Testing Materials, and further, that all cement for such uses shall be tested by a competent engineer.

A paper on the "Use of Concrete from an Architect's Standpoint," was read by Mr. A. O. Elzner, in which he takes up the possibility, and encourages architects and engineers, to propagate the artistic treatment of concrete surfaces.

Mr. H. H. Quimby, of Philadelphia, Pa., discussed the

matter of "Finish for Concrete Surfaces," in which he brought out the active demand for a means of putting forth more artistic and pleasing effect to the eye upon cement structures.

The Artistic Treatment of Concrete was taken up by Mr. Lynn White of Chicago, in a paper in which this subject was thoroughly discussed. He also encourages the artistic development of concrete surfaces and brings out the ways and means of obtaining this end.

A paper on Concrete Blocks was read by Mr. H. H. Rice, in which he discusses the different forms and construction of which blocks can be used, also the encouragement of the different size blocks in construction to make the structure appear less symmetrical and more pleasing to the eye. He also devotes considerable space to the processes and machines used in successful work.

Mr. S. B. Newberry of Sandusky, Ohio, stood up before the convention for a considerable length of time and acted as a target for all manners of questions regarding concrete construction. The interest shown in this branch was very marked, and for sometime the questions came thick and fast.

A series of "Tests on Building Blocks," were read by Mr. R. D. Kneale, Purdue University, in which he gives results of tests made on some thirty plain concrete building blocks which were about one year old. The matter of proper conditions in mixing, the different materials used, etc., is thoroughly discussed, after which an itemized statement of the modulus of rupture of each block is given. Mr. Kneale's test is one of very great value to the man who is following this line.

A paper on "Machinery for Cement Users," by Mr. J. F. Angell, took up the matter of machinery for cement users very thoroughly, and all machinery of the latest type connected with concrete construction was discussed.

The "Advantage of Water Proofing," by Mr. G. F. Fry, was very interesting. It was the reader's idea to put before the convention the matter of making cement building construction more desirable in the way of adding a water-proofing compound making same practically water-tight. This is a new field and practically undeveloped.

The Report of the Committee on Fire-Proof and Insurance, by Mr. E. T. Cairns, brought out some interesting progress which has been carried on in the past year in the development of resistive qualities of concrete.

The officers of this association were as follows: President, Richard L. Humphrey, Philadelphia, Pa.; 1st Vice-President, Merrill Watson, New York, N. Y.; 2nd Vice-President, J. H. Fellows, Scranton, Pa.; 3rd Vice-President, O. U. Miracle, Minneapolis, Minn.; 4th Vice-President, A. Monstead, Milwaukee, Wis.; Secretary, W. W. Curtis, Chicago, Illinois; Treasurer, H. C. Turner, New York, N. Y.

The 1908 Convention of the National Association of Cement Users will be held at Columbus, Ohio.

Communication

Locating a Turnout on Inside of Curve

Editor Railway Engineering:

I was pleased to note in your last issue the announcement that a question and answer department was to be a feature of your paper. This is certainly a move in the right direction, as a trackman often runs up against a problem that puzzles him.

I have a 5½ degree curve in the main track and next spring I am going to put in a spur track for a warehouse, something like shown in the rough sketch I send herewith. What I want to know is what number frog will give the best results so the curve of the switch will not exceed 15 degrees. As you see the switch turns off from the inside of curve. Would like this explained in the next issue if possible.

YARD FOREMAN.

The problem referred to is represented by the annexed diagram where A is the frog point and BF is point of switch. BG is the outer gauge line of the main track. To get it in a simple way it must be remembered that when a switch is taken from the inside of a curve that the turn-out curve is sharper than the main track by as many degrees as the turn-out curve measures, were it taken from a straight line. If it is now assumed that 15 degrees is the required curvature of switch BA, then by subtracting 5½ from 15 we obtain the turn-out curve for the required frog at A, and by consulting a table of frogs and switch leads we find that 9½ degrees is almost exactly the degree of curve belonging to a number 8 frog. So the offhand answer to "Yard Foreman's" inquiry is that a No. 8 frog will do the business, giving a turn-out curve of just 15 degrees.

Assuming that a split switch is contemplated with 15 ft. points the lead from F to A should be 72 ft. It is not

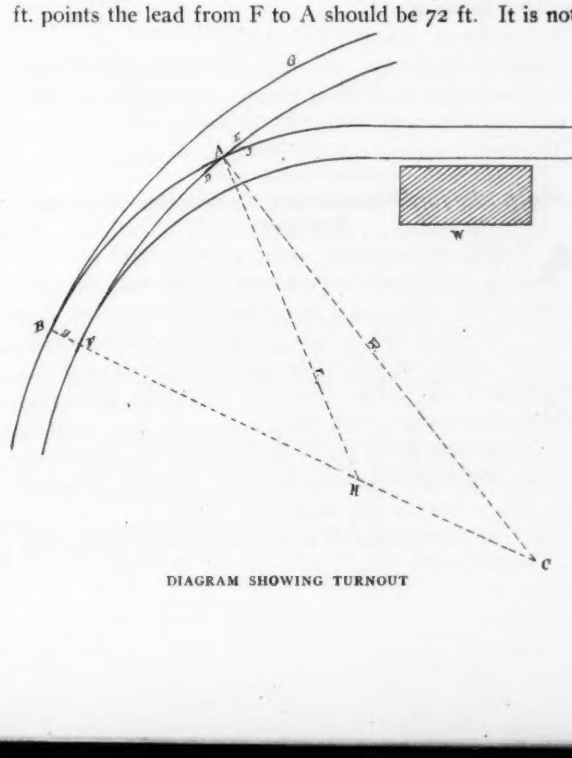


DIAGRAM SHOWING TURNOUT

very good practice to build switches of this kind except where it cannot be helped, and then care should be taken that the locality is such that trains run at a low speed, and if possible the frog should be curved to suit the conditions, that is, wing DE should be curved for $5\frac{1}{2}$ degrees and the other wing for 15 degrees curve; if the frog is straight it is easily seen that there will be a flat place at DE in the main track which should be avoided, or at least it should be made as short as possible, which can be done by using a short frog.

The problem is interesting from the point of view of the Engineer and Roadmaster as well, and a mathematical solution may be useful. Let C be the center of curve FA and H the center of curve BA; let Radius AC=R and Radius AH=r and gauge BF=g, then the frog angle EAJ can be computed, since in the triangle ACH the three sides are known, namely AC=R, AH=r and CH=R+g—r; consequently: $\text{Cos HAC} = \text{Cos EAJ} = R^2+r^2-(R+g-r)^2 \div 2Rr$.

This gives the trigonomterical function of the frog angle which can be figured out and the angle looked up in a trigonometrical table.

To apply this to the problem under consideration we assume that Radius AC=1093 ft., radius AH=383 ft., BF=4.71 ft.; then: $\text{Cos EAJ} = 1194649+146689-510810 \div 837238$.

$\text{Cos EAJ} = .99198$.

Looking up this angle in a table of functions, we find angle $\text{EAJ} = 7^\circ\ 16'$; to find the number of frog required consult the table of Cotangents for the angle $7^\circ\ 16'$ and we find 7.84, which is very nearly 8. Thus a Number 8 frog will fill the bill very well.

There is another way to find the number of Frog when the angle is given which is as follows:

A Number 1 frog contains 3438 minutes of an angle, and a No. 10 frog contains the 10th part of 3438 minutes. So if we call the number of frog X and the frog angle A the following simple relations obtains approximately:

$3438 \div X = A$,

from which we get:

$X = 3438 \div A$.

Applying this to our case, it must be remembered that the angle A must be given in minutes; hence $7^\circ\ 16' = 436'$; divide this into 3438 gives 7.89, or nearly a No. 8 frog.

This result again corroborates the above deductions.

Methods for Preventing Corrosion of Steel Bridges

AS WE are gradually moving away from the old style wooden pile bridges used on railroads and substituting steel bridges, it is becoming more and more of a problem to the engineers how to eliminate the corrosion of steel bridges caused by the action of salt brine from refrigerator cars. The corrosion caused by salt brine coming into contact with steel bridges is very marked and shortens the life of the bridge from two to four years.

Some railroads have already taken steps to eliminate this evil in one of the following ways:

(a) The top member of each steel girder is coated well with a thick coat of paint. A strip of ruberiod patent roofing, tar paper, or some similar covering is then laid upon the fresh paint, the paint causing the covering to adhere tight to the girder. This covering is cut sufficiently large to allow it to overlap the girder on each side from one to two inches, thereby protecting the steel from brine dropping from cars passing over the bridge. The bridge ties and rail are then placed upon this covering, leaving the top member of each girder entirely covered.

(b) The entire bridge deck is ballasted, that is, the open spaces ordinarily left between the ties are filled in with strips of wood making the entire deck secure. Gravel is then distributed all over the top of the bridge to a depth of four or five inches.

(c) Steel incased in concrete.

(d) Reinforced concrete decks anchored on top of the steel girders.

The construction described in method (a) has been found from practice to do fairly well as long as the covering is not cut by the ties. The ties generally imbed themselves into the covering and finally through the raising and lowering of the ties, caused by passing trains, cuts the covering along the sharp edge of the tie. As soon as the covering is cut the salt brine has an opportunity to work its way down to the steel girder. The brine first strikes the side of the tie and thence by gravity runs down the side of tie to the steel girder. This method while not as efficient as some others does very well for the money invested.

In method (b) while it is a little more expensive to construct, it serves more than one purpose. If the bridge is kept well ballasted it not only eliminates the salt brine evil, but also is a great safeguard against fire. With these two factors in view some railroads are adopting this construction on bridges, which have old decks but still are in fairly good condition for service a year or two longer. On the other hand, unless carefully cared for there is great danger of the gravel finally washing or drifting off the bridge by continued rain and suction caused by passing trains that the danger from fire is greater than before, insomuch as the red hot clinkers will fall upon the bare bridge, and having no way to pass down through will ignite the deck. With the deck in this condition (that is, with hardly no ballast upon it) the salt brine will have practically the same opportunity to reach the girder as it had in the old construction of placing ties and rail directly upon the girders. The strips of wood which are placed between the ties are never made tight, the object of which is to let the water pass off of the bridge.

The concrete work described in the last two methods, while a little more expensive to construct, is the more durable and economical in the long run.

Cinder Pit Facilities

A LITTLE observation of the number of engines standing outside of the round-house waiting for room over the cinder pits will in a number of instances explain the reason for terminal delays. While in such

position locomotives are idle in every sense of the word, for they are not only out of service but so located as well that no boiler washing may be done and little or no repair work may be accomplished. To obviate this difficulty it is necessary either to arrange for greater cinder pit accommodations or install mechanical devices by means of which the ash may be readily disposed of. Even with such mechanical devices sufficient length of pit should be provided to accommodate the demand and so delay the locomotives as little as possible. Requirements of this nature are particularly noticeable at old round-houses where the work required has outgrown the facilities, and some roads have awakened to this fact and are making provisions to increase the length of cinder pits and provide more efficient coal and ash handling schemes.

By handling coal and ash with the same mechanical system and my arranging the sand supply and water cranes near at hand, much time may be saved in the movement of the locomotive before entering the roundhouse. As an example of operation with mechanical appliances for handling coal and ash systematically, together with ample cinder pit space, we quote the following figures selected at random from a daily report of locomotive departures, the figures indicating the average numbers of hours that each engine was held, from the time of first reaching yard to actual time of departure, including time of all delays and time consumed in repairs, etc.: 5 hours, 46 minutes; 6 hours, 28 4-17 minutes; 5 hours, 37 7-9 minutes; 4 hours, 47 1-7 minutes; 4 hours, 24 minutes. On one occassion at the roundhouse from which the above figures were selected, it was desired to determine how rapidly it was possible to clean a number of engines and by actual trial 15 engines were cleaned, knocking out fires entirely, coaled and sanded from 7 a. m to 10 a. m., the work being done by four hostlers and four helpers.

Prices of Track Materials, F. O. B., Chicago

TRACK SUPPLIES.

	Retail price per cwt.	Mill price.
Steel Rail, 60 lbs. and over ...		$28.00 per gross ton
Steel Rail, 30 to 45 lbs...	$1.75	33.00 per gross ton
Steel Rail, 25 lbs.........	1.80	34.00 per gross ton
Steel Rail, 20 lbs.........	1.80	33.00 per gross ton
Steel Rail, 16 lbs.........	1.80	36.00 per gross ton
Steel Rail, 12 lbs.........	2.10	37.00 per gross ton
Ties, 6x8x8 oak, 1st grade...............		75c. each
Ties, 6x8x8 oak, 2d grade...............		60c. each
Switch Ties		$30.00 M. ft.

Angle bars accompanying rail orders, 1907 delivery, 1.65c.; car lots, 1.90c.; Spikes, 2.25c.; Track bolts, 2.65c. to 2.75c., base, square nuts, and 2.80c. to 2.90c., base hexagon nuts. The store prices on track supplies range from 15c. to 20c. above mill price. Switch set per turn cut, $175 to $200.

OLD MATERIAL.

Old Steel Rail....................$16.50 per gr. ton
Old Iron Rail..................... 23.00 per gr. ton

SHEET STEEL.

It is quoted for future delivery: Tank Plates, ¼-in. and heavier, wider than 6¼ and up to 100 in. wide, inclusive, car lots, Chicago, 1.76½c. to 1.86½c.; 3-16-in., 1.86½ to 1.96½c.; Nos. 7 and 8 gauge, 1.91½c. to 2.01½c.; No. 9, 2.01½c. to 2.11½c.; Flange quality, in widths up to 100 in., 1.86½c. to 1.96½c., base, for ¼-in. and heavier, with the same advance for lighter weights; Sketch Plates, Tank quality, 1.86½c. to 1.96½c.; Flange quality, 1.96½c. Store prices on Plates are as follows: Tank Plate, ¼-in. and heavier, up to 72 in. wide, 2c. to 2.10c.; from 72 to 96 in. wide, 2.10c. to 2.20c.; 3-16-in., up to 60 in. wide, 2.10c. to 2.20c.; 72 in. wide, 2.35c. to 2.45c.; No. 8 up to 60 in. wide, 2.15c. to 2.25c.; Flange and Head quality, 0.25c. extra.

STRUCTURAL STEEL SHAPES.

Store quotations are unchanged at 2.05c. to 2.10c., and mill prices are as follows: Beams and Channels, 3 to 15 in., inclusive, 1.86½c.; Angles, 3 to 6 in., ¼-in. and heavier, 1.86½c.; larger than 6 in. on one or both legs, 1.96½c.; Beams, larger than 15 in., 1.96½c.; Zees, 3 in. and over, 1.86½c.; Tees, 3 in. and over, 1.91½c., in addition to the usual extras for cutting to extra lengths, punching, coping, bending and other shop work.

CAST IRON PIPE.

Quotations on Water Pipe remain unchanged and the market is firm at the following prices: 4 to 6 in., $35; 6 to 12 in., $33; over 12-in., average $30, with $1 per ton extra for Gas Pipe.

CEMENT.

	Package.
	$1.85 in wood
Good grade Portland Cement........	1.65 in paper
	*1.85 in duck

*(Duck sacks credited when returned.)

SAND.

Bank sand .... 60c. per yd.
Torpedo sand ....$1.10 per yd.

CRUSHED STONE AND GRAVEL.

Crushed limestone ....$1.10 per yd.
Crushed gravel .... 1.00 per yd.

Personals

Mr. A. M. Mullinix, assistant superintendent of bridges and buildings and water service of the Fort Worth & Denver City, has been appointed superintendent of bridges and buildings and water service, with office at Fort Worth, Tex., to succeed Mr. O. J. Travis, resigned.

Mr. J. S. Peter has been appointed superintendent of maintenance of way of the San Antonio & Aransas Pass railway, with office at Yoakum, Tex., to succeed Mr. William Berry, resigned.

Mr. W. H. Willis has been appointed signal engineer of the Erie Railroad with office at New York, to succeed Mr. C. H. Morrison, resigned.

Mr. L. E. Kinch has been appointed supervisor of signals of the Monongahela division of the Pennsylvania

Railroad, at Pittsburg, Pa., to succeed Mr. W. N. Schure, who has been transferred to Harrisburg, Pa. Mr. E. J. Clark, heretofore supervisor of signals at Baltimore, Md., has been transferred to the Pittsburg division, at Pittsburg, Pa., to succeed Mr. Kinch.

Mr. C. H. Morrison has been appointed signal engineer of the New York, New Haven & Hartford.

Mr. J. M. Nunn, roadmaster of the Chicago, Milwaukee & St. Paul at Marion, Ia., has been transferred to Des Moines, Ia., in a similar capacity.

Mr. C. Dougherty has been appointed assistant engineer of the Cincinnati, New Orleans & Texas Pacific, with office at Cincinnati, O.

Mr. H. Rettinghouse has been appointed division engineer of the Chicago & Northwestern at Boone, Ia., to succeed Mr. B. J. Sweatt, resigned. Mr. Rettinghouse has heretofore been division engineer of the Wisconsin Central at Fond du Lac, Wis.

Mr. F. M. Hill has been appointed assistant superintendent of buildings of the Michigan Central with office at Jackson, Mich.

Mr. J. E. Murphy has been appointed resident engineer of the Louisiana Western with office at Lafayette, La. Mr. Murphy has heretofore been roadmaster of the Texas & New Orleans at Houston, Tex., and has been succeeded in that position by Mr. J. E. Sweeney, transferred from Dallas, Tex.

Mr. G. H. Nickerson has been appointed chief engineer of the Yosemite Valley Railroad, with office at Merced, Cal., to succeed Mr. N. C. Ray, resigned. Mr. Nickerson will have charge of construction and permanent maintenance of way.

Mr. R. B. Robinson has been appointed division engineer of the Oregon Short Line with office at Salt Lake City, Utah, to succeed Mr. H. J. Harris, resigned.

Mr. W. W. Gaffin has been appointed division engineer of the Chicago & Northwestern, with headquarters at Fond du Lac, Wis.

Mr. J. L. Albers has been appointed assistant bridge engineer of the Atchison, Topeka & Santa Fe, with office at Chicago.

Mr. W. S. Greenfield has been appointed superintendent of buildings of the Illinois Central, with office at Chicago. Mr. Greenfield succeeds Mr. T. S. Leake, whose title was master carpenter.

Mr. H. E. Warrington, heretofore principal assistant engineer of the Cincinnati, New Orleans & Texas Pacific, has been appointed chief engineer of that company, with office at Cincinnati, O., to succeed Mr. George B. Nicholson, deceased.

The titles of Mr. W. H. Earl, Newton, Kas., and Mr. M. N. Wells, Chanute, Kas., resident engineers of the Santa Fe, have been changed to division engineers. The following assistant engineers have also had their titles changed to division engineers: C. E. Griggs, Chillicothe, Ill.; H. W. Wagner, Marceline, Mo.; C. J. Skinner, Kansas City, Mo.; G. J. Graves, Topeka, Kas.; W. S. Ruggles, Arkansas City, Kas.; L. C. Lawton, Dodge City, Kas.; E. S. Mudge, Wellington, Kas.; J. A. Roach, La Junta, Colo.; D. E. Helvern, Pueblo, Colo.; B. H. Newlee, Las Vegas, N. Mex.; Claude Betson, San Marcial, N Mex.

Mr. A. Palm, roadmaster of the Union Pacific at Rawlins, Wyo., has been transferred to Laramie, Wyo., to succeed Mr. S. Wilburn, resigned.

Mr. W. J. Bergen, assistant chief engineer of the New York, Chicago & St. Louis, has been appointed chief supervisor of track, with office at Bellevue, O., to succeed Mr. John Clark, resigned. Mr. A. J. Himes, heretofore bridge engineer, has been appointed assistant chief engineer, with office at Cleveland, O., and Mr. G. H. Tinker has been appointed bridge engineer to succeed Mr. Himes.

Mr. E. E. Pratt, Jr., has been appointed superintendent of buildings of the New York, New Haven & Hartford, with office at New Haven, Conn., to succeed Mr. G. B. Mitchell, resigned.

Mr. Woodbury Howe, assistant engineer of the Santa Fe, has been appointed principal assistant engineer, in charge of location and grade reduction, with headquarters at Topeka, Kas.

Mr. George Tisdale, heretofore general foreman of bridges, buildings and water service of the Santa Fe, Prescott & Phœnix, has been appointed superintendent of bridges, buildings and water service of the same road, with office at Prescott, Ariz.

Mr. J. C. Nelson, heretofore assistant engineer of the Alabama Great Southern, and who was recently appointed principal assistant engineer of the Cincinnati, New Orleans & Texas Pacific, did not assume the latter position, but has been appointed chief engineer of the Seaboard Air Line, in charge of maintenance of way, with office at Portsmouth, Va.

Mr. W. E. Condon has been appointed chief engineer of the Nevada Northern, with office at Ely, Nev.

Mr. Frank T. Darrow, engineer of maintenance of way of the Chicago, Burlington & Quincy at Lincoln, Neb., has been appointed principal assistant engineer, with office at the same place.

Mr. J. K. Sroufe, engineer of maintenance of way of the Chicago, Cincinnati & Louisville, has resigned, and the office has been abolished.

Mr. George B. Herrington has been appointed chief engineer of the Georgia Southern & Florida, with office at Macon, Ga., to succeed Mr. J. J. Gaillard, resigned.

Mr. C. W. Moorman, roadmaster of the Louisville & Atlantic, has been appointed engineer of maintenance of way, with office at Versailles, Ky.

Mr. J. A. Jaeger has been appointed chief engineer of the Santa Fe, Prescott & Phœnix, with office at Prescott, Ariz., succeeding Mr. W. A. Drake, promoted. Mr. S W. Higley, heretotore roadmaster, has been given the title of superintendent of track, with office at Prescott, Ariz.

Mr. D. M. Taylor has been appointed assitant engineer of the Wheeling & Lake Erie, with office at Cleveland, O., in charge of the extensive terminal improvements the company will make at that point.

Mr. T. H. Beacom, superintendent of the Chicago, Rock Island & Pacific at Oklahoma City, Okla., has been transferred to Chickasha, I. T., to succeed Mr. A. C. McColl, resigned.

Mr. P. C. Allen, superintendent of the Willmar & Sioux Falls, has been transferred to Great Falls, Mont., as superintendent of the Montana Central. Mr. R. I. Knebel succeeds Mr. Allen as superintendent of the Willmar & Sioux Falls, with office at Willmar, Minn.

Mr. W. N. Polk, heretofore assistant engineer, has been appointed superintendent of the Baltimore, Chesapeake & Atlantic, with office at Salisbury, Md., to succeed Mr. A. J. Benjamin, deceased.

Mr. W. H. Wright has been appointed superintendent of the Central of Georgia, with office at Savannah, Ga., to succeed Mr. J. C. O'Dell.

Mr. D. W. Boh has been appointed superintendent of the Mt. Jewett, Kinzua & Riterville, with office at Kushequa, Pa., to succeed Mr. B. J. Barnett, resigned. Mr. Boh has heretofore been signal inspector on the Erie.

Following the appointment of Mr. F. C. Batchelder as general superintendent of the Baltimore & Ohio at Baltimore, Md., to succeed Mr. C. C. F. Bent, the following changes are announced: Mr. B. W. Duer, superintendent at Pittsburg, Pa., has been transferred to Chicago to succeed Mr. F. C. Batchelder, and Mr. E. A. Peck has been transferred from New Castle to Pittsburg, Pa., to succeed Mr. Duer. Mr. H. H. Temple, heretofore engineer of maintenance of way at Pittsburg, has been appointed superintendent at New Castle, Pa., to succeed Mr. Peck.

Mr. James T. Gillick, superintendent of the Chicago, Milwaukee & St. Paul at Des Moines, Ia., has been transferred to Chicago, in a similar capacity, and Mr. J. M. Oxley has been appointed superintendent at Des Moines, Ia., to succeed Mr. Gillick.

Mr. T. A. Wilson has been appointed superintendent of the Missouri, Kansas & Texas at Smithville, Tex., to succeed Mr. J. H. Davisson, resigned.

Mr. E. E. Young has been appointed superintendent of the Chicago, Burlington & Quincy at McCook, Neb., to succeed Mr. C. L. Eaton, resigned.

Mr. J. W. Robins, division superintendent of the Gulf, Colorado & Santa Fe, at Cleburne, Tex., has been appointed vice president and superintendent of the Chicago, Rock Island & Gulf, with office at Fort Worth, Tex., to succeed Mr. S. B. Hovey, resigned.

Mr. H. V. Hilliker has been succeeded as superintendent of the Oregon Short Line at Salt Lake City, Utah, by Mr. W. E. Costello.

Mr. H. C. Storey has been appointed superintendent of the Santa Fe, Prescott & Phœnix, with office at Prescott, Ariz.

Mr. John Glenn has been appointed superintendent of the Gulf, Colorado & Santa Fe at Beaumont, Tex., to succeed Mr. A. P. Hall, transferred to Cleburne, Tex., in place of Mr. J. W. Robins, resigned.

Mr. P. A. Buck has been appointed superintendent of the Missouri Pacific with office at Chester, Ill., to succeed Mr. B. G. Fallis, resigned.

The Southern Railway has created eleven new divisions, and the following superintendents have been appointed: G. V. Peyton, Durham, N. C.; J. M. Bennett, Winston-Salem, N. C.; J. A. Heether, Greenville, S. C.; A. M. Smith, Columbia, S. C.; R. E. Simpson, Rock Hill, S. C.; D. W. Newell, Winston-Salem, N. C.; T. S. Boswell, Byson, N. C.; E. E. Norris, Knoxville, Tenn.; C. C. Fodger, Chattanooga, Tenn.; W. J. Bell, Williamson, Ga.; J. Lasseter, Williamson, Ga.; W. S. Andrews, Danville, Va.; E. P. Pelcer, Nashville, Tenn.

As a result of an increase in the number of operating districts of Atlantic Coast Line, the following superintendents have been appointed: E. R. Wooten, Richmond, Va.; J. B. Hughes (acting), Norfolk, Va.; G. B. McClellan, Rocky Mount, N. C.; E. Phenneger, Wilmington, N. C.; J. A. Fountain, Wilmington, N. C.; G. D. Pugh, Charleston, S. C.; C. L. Porter, Florence, S. C.; R. B. Hare, Florence, S. C.; F. M. Doar, Savannah, Ga.; R. A. McCranie, Waycross, Ga.; S. B. Calhoun, Albany, Ga.; S. B. Bennett, Montgomery, Ala.; L. E. Spencer, Jacksonville, Fla.; A. P. Connelly, Sanford, Fla.; J. C. Higgins, Sanford, Fla.; H. O. McArthur, Gainesville, Fla.; J. F. Council, Lakeland, Fla.; O. H. Page, Jacksonville, Fla.

New Factory of the Wadsworth-Howland Co.

During September, 1906, the plant of the Wadsworth-Howland Company, paint and color-makers, was destroyed by fire. The company has since moved into new quarters, which are much larger than the former establishment. The new plant is commodious and is fully equipped with new and modern machinery and all other facilities necessary to turning out in large quantities the well-known paints of this concern. Some idea

NEW FACTORY OF THE WADSWORTH-HOWLAND CO.

of the size and appearance of the present factory may be had by reference to the accompanying half-tone engraving, which illustrates the exterior of the commodious quarters providing for the increased facilities.

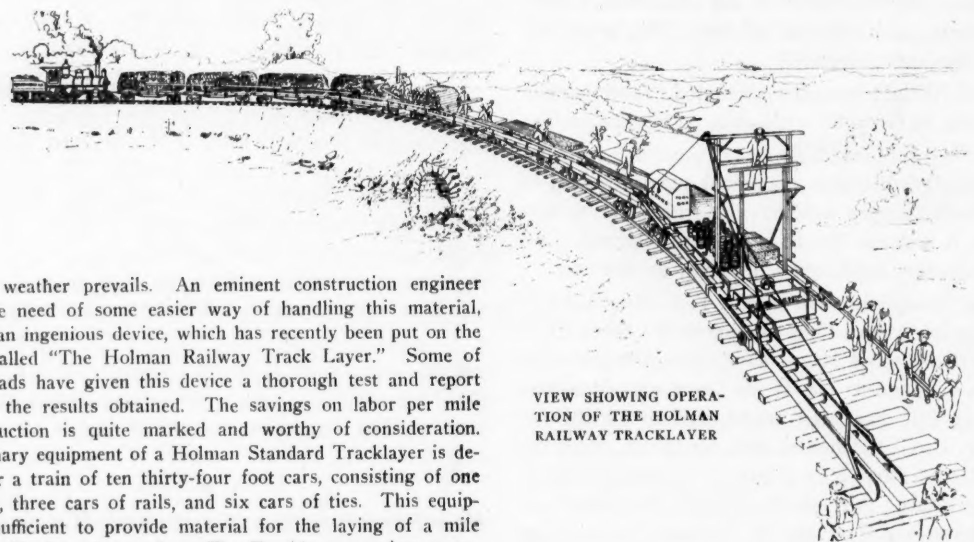
The company is now better prepared than ever to meet the

demands of the trade. In this connection it is interesting to observe that even though hampered by the inconvenience occasioned by fire, the company has continued to supply the trade satisfactorily and with usual promptness, due to the characteristic energy of the members of the company and to the assistance of friends in the same line.

The present factory of the Wadsworth-Howland Company is located at the corner of Fulton and Carpenter streets, Chicago, Ill.

The Holman Tracklayer

To the railroad construction engineer nothing need be said as to the methods followed out in tracklaying, but for those not so familiar it may seem appropriate to say the labor and inconvenience of carrying the ties and rail forward is quite marked. Especially so when the roadbed is made up of clay and wet weather prevails. An eminent construction engineer seeing the need of some easier way of handling this material, invented an ingenious device, which has recently been put on the market, called "The Holman Railway Track Layer." Some of the railroads have given this device a thorough test and report favorably the results obtained. The savings on labor per mile of construction is quite marked and worthy of consideration. The ordinary equipment of a Holman Standard Tracklayer is designed for a train of ten thirty-four foot cars, consisting of one tracklayer, three cars of rails, and six cars of ties. This equipment is sufficient to provide material for the laying of a mile and one-half of track per day. The Tracklayer consists essentially of a series of trams or frames with iron rollers on each side of the train, supported by adjustable iron brackets which fit into the pockets on the sides of the cars. These trams thus form a continuous tramway, extending the full length of the train, or as far as desired. The ties and rails are thrown upon these trams and rolled to the front, where men receive and place them in position on the road-bed. The left-hand side, shown in figure, is called the tie side. A chute, placed on the tie side, supported by a wire cable, extends forward a distance of about thirty-five feet, where the ties are delivered at a point beyond the rails which are being laid. The men handling the ties are consequently out of the way of the men who are laying and spiking the rails.



VIEW SHOWING OPERATION OF THE HOLMAN RAILWAY TRACKLAYER

Provision is made for laying track on a curve by adding an adjustment, permitting the end of the chute to be moved to either the right or left as desired. This attachment is of particular advantage in laying track on bridges or trestles.

The Apalachicola Northern in Florida, the Newton & Northwestern Railway, and Charlotte Harbor & Northern Railway in Florida are using this device daily, with good results.

Any further information may be had by addressing D. F. Holman Railway Tracklayer Co., 1749 Railway Exchange, Chicago, Ill.

Miscellany

The Quincy, Manchester, Sargent Co., with offices in Chicago and New York, has secured the exclusive rights for the manufacture and sale of the "Bull-Dog" anti-rail creeper, formerly manufactured by the Bryan Mfg. Co., of Racine, Wis.

Messrs. S. F. Bowser & Co., Inc., Fort Wayne, Ind., announces that owing to the large increase in business during the year 1906, about 75 per cent. greater than that of 1905, and three times that of 1904, the company has found it necessary to open a branch office at 299 Broadway, New York City. This office is in charge of Mr. W. T. Hatmaker, formerly manager of the mail order department of the company's Boston, Mass., branch. The opening of this office is only one of the many additions which have been made in the past year. The company's factory in Fort Wayne has been increased in size 125 per cent., and the Fort Wayne office has been quadrupled. In addition, it has built and just moved into a $25,000 factory at Toronto, Canada, and has added over sixty salesmen to the selling force.

The D. F. Holman Railway Tracklayer Co., Railway Exchange, Chicago, recently installed one of the Holman railway tracklayers on the Apalachicola Northern Railway in Florida.

Mr. Howard M. Post recently accepted the position of advertising manager with the Quincy, Manchester, Sargent Company, manufacturers of railroad appliances, with offices in Chicago and New York, and factories at Chicago Heights, Ill.; Milwaukee, Wis., and Plainfield, N. J., this company being the successor to the Railway Appliances Company, The Q. & C. Company, and The Pedrick & Ayer Company. The Quincy, Manchester & Sargent Company is also the sole agent for the Milwaukee Elastic Nut and Bolt Company. Mr. Post has for some time been advertising manager for the Kellogg Switchboard & Supply Company, of Chicago.

A new edition of a pamphlet called "Track" has been issued by the Railroad Supply Co., Bedford Bldg., Chicago. This pamphlet contains 140 pages, 5¾x2¾ in., and a copy of it will be mailed free upon request. The book contains illustrations and descriptions of tie plates, track tools, track bolts, nut locks, spikes, guard rail clamps, plugs, derailers, cattle guards, bumping posts, switches, switch stands, frogs, signal equipment, etc., etc. A number of tables, of value to those who are engaged in the maintenance of track, are also given.

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